CIVIL ENGINEERING

GATEWAY CENTER PROJECT

in Pittsburgh during construction

See article by Di Stasio and van Buren

CBS TELEVISION
CBS TELEVISION
J. HAMMER

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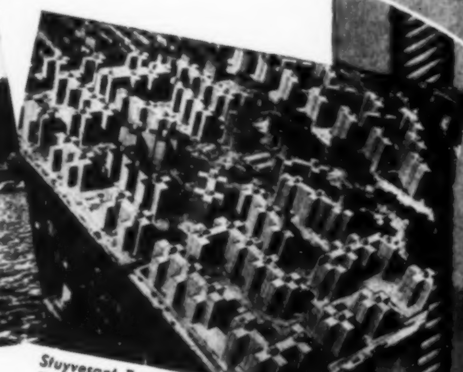
CYLINDRICAL PILES CARRY BIGGER LOADS BECAUSE THEY ARE

BIG *Where it counts!*

Marathon Paper Company's pulp mill, Ontario, Canada—rests securely on Western's Pedestal piles.



Stuyvesant Town, N. Y. C.—38,000 Button Bottom piles, over 1¾ million lineal feet, support 35 thirteen-story buildings.

Left, Button Bottom pile; right, Pedestal pile. The enlarged bases provide high carrying capacities.

BIG WHERE IT COUNTS, WESTERN'S Button Bottom and Pedestal piles distribute their loads over a greater area in the dependable strata to develop full carrying capacity.

WESTERN'S CYLINDRICAL PILES—full diameter for full depth—penetrate poor bearing strata to reach dependable soils below. Their large circumferential and cross-sectional areas give higher load capacities, both frictional and end-bearing.

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This cast iron water main, uncovered for inspection, is in good condition after over 110 years of service in Mobile, Ala.—one of more than 45 cities with century-old water or gas mains in service.

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Lithographed on stone for U. S. Pipe and Foundry Co. by John A. Noble, A. N. A.

Weston Power Plant, Rothschild, Wis.—Engineers: Pioneer Service & Engineering Co., Chicago, Ill.—Owner: Wisconsin Public Service Corporation, Milwaukee, Wis.

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Construction costs took a nose dive when the engineers on the Weston Power Plant constructed an earth-fill cofferdam and predrained the wet excavation with a Moretrench Wellpoint System.

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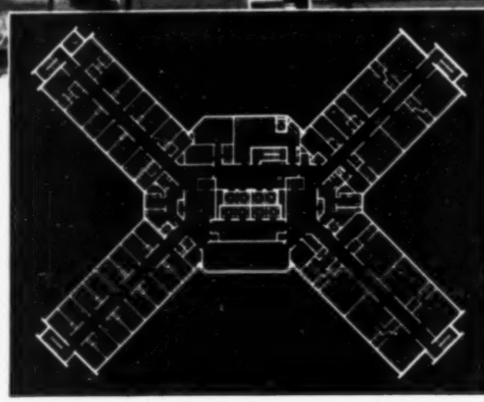
Memorial Unit of Grace-New Haven Community Hospital, New Haven, Conn.; *Architect:* Douglas Orr; *Contractor:* The Dwight Building Co.; *Structural Engineer:* Henry A. Pfisterer; *Mechanical Engineers:* Hubbard, Lawless & Blakeley; steel fabrication and erection by Bethlehem.



Floor plan, showing arrangement of wings.

NEW UNIT FOR HOSPITAL IN NEW HAVEN

At York St. and South St., in New Haven, Conn., stands this impressive gray-brick structure, the Memorial Unit of the Grace-New Haven Community Hospital. The recently completed hospital building is a neighbor of the famous Yale School of Medicine. It is the largest structure erected in New Haven since 1930.

The Memorial Unit, 9 stories in height and with four wings, can accommodate 337 patients. Provision has been made for the construction of three additional stories. The building is shaped like a modified "X" to provide maximum light and air. On the upper floors each half of the "X" forms a V-shaped patient division. A nursing station is located at the apex of each "V," making visible each patient doorway.

The partially air-conditioned structure has a 12-story central core containing a bank of six elevators. All other utilities are located in this core, to minimize the passage of noise to the wings. An entire floor is set aside for mechanical services.

Bethlehem fabricated and also erected the 2200 tons of steel which were used to make up the framework for this important addition to New Haven's growing hospital system.

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BETHLEHEM STEEL

BETHLEHEM STEEL

Caterpillar Diesel armada pushes through new Pensacola jet base

THIS NO. 12 Motor Grader is leveling one of the long jet runways at the Forrest Sherman base.

A CAT D13000 Diesel Engine powers a Bucyrus-Erie dragline, moving shell from stock pile to crusher.

Building the roads and runways for the new Forrest Sherman jet base at Pensacola, Florida, is pretty much a Caterpillar show. Smith Engineering & Construction Co., of Pensacola, uses about 75 of the big yellow machines, including all types of equipment.

The land on which the installation is being built was an Army fort during the last war, and will now become part of the big Pensacola Naval Air Station. The runways are 70% crushed shell mixed with 30% sand and spread 17 inches deep. This is compacted to a 12-inch finished base.

Earth taken from the cut for the runways is used as fill for a new entrance road to the field. 180,000 cubic yards will be moved on the road-building job, and it is being done by fast Cat DW21 Tractors and No. 21 Scrapers, hauling loads up to 20 heaped yards.

A Woods mixer, pulled by a D8 Tractor, is used for rapid mixing of the runway material. And Cat No. 12 Motor Graders prepare the ground and level the mix.

Mr. A. W. Gordon, Superintendent, says: "At one time we had about 50 machines of other makes. We've gradually sold them out and standardized on Caterpillar. I'm partial to them, having worked one of the first tractors sold, back in 1928. Some of our

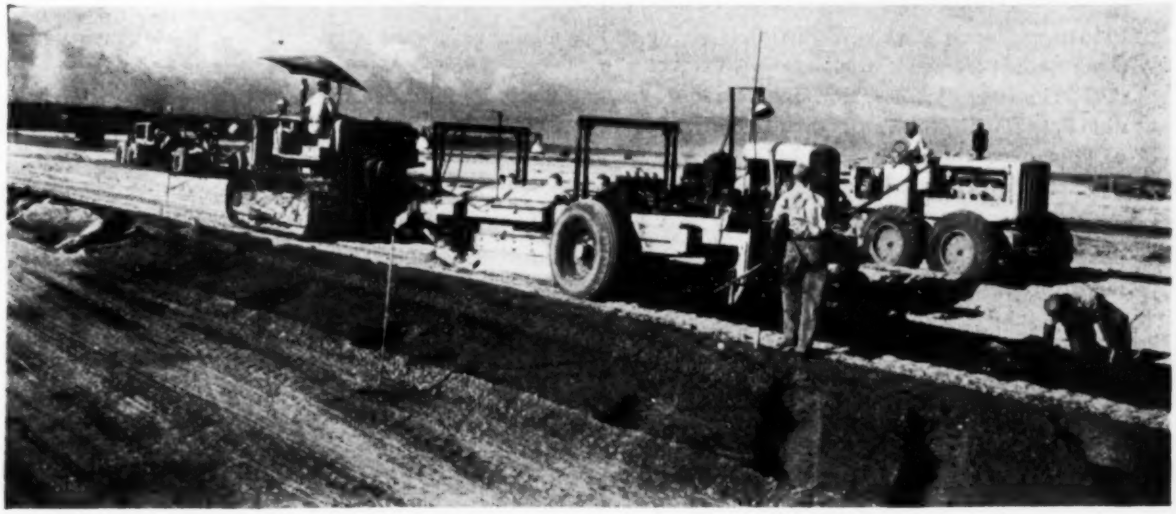
present Cat equipment is more than 10 years old and still running strong."

Standardizing on Caterpillar machines is sound practice. It simplifies the problem of operator training, allows quick repairs with interchangeable parts, and places undivided responsibility on one manufacturer and one dealer.

Your Caterpillar Dealer has the right equipment for your job, and he'll back its rugged stamina and long work life with reliable service and genuine Caterpillar parts. He's as close as your phone. Call him today.

ROLLING at 20 mph., a Cat DW21-Scraper unit hauls big loads fast for building an entrance road.

A CATERPILLAR D8 Tractor pulls this Woods mixer, laying crushed shell and sand for a runway.



CATERPILLAR TRACTOR CO., PEORIA, ILLINOIS

"Big Red"

Contractor completes job 45 days ahead of estimate as TD-24 fleet moves a million yards

Ryan Construction Company, Evansville, Indiana, took on a big job when they contracted to move a million cubic yards of dirt and place 35,000 tons of riprap in site preparation for a new steam generator plant on the Ohio River.

From the first day on the contract, Ryan's five TD-24's made the dirt fly. Their assignment: to cut down two hills and dump the excavated material in old creek bed to make a new power plant site.

They averaged 4 minutes and 40 seconds on the 2,000 foot round trip between cut and fill. Self-loading heaped

SWIFT SELF-LOADING A pair of hustling TD-24's charge ahead, self-loading 18 yard scrapers as they go. Five of these fast Internationals helped keep the job ahead of schedule.

TD 24 Rolls for Ryan

scrapers, the Big Red fleet moved tremendous yardages every day—kept doing it even in rain and mud, the Ryan people report.

TD-24's are the fastest and most powerful crawlers on the market. That's why "Big Red" performance is paying off not only for Ryan but for contractors across the country who need big crawler power to get tough jobs done on time.

And you can't beat the service provided by your nearby International Industrial Distributor. His trained servicemen, complete stocks of parts and up-to-date shop facilities are available to you anywhere, anytime to keep your equipment in production.

He and the famous line of IH crawlers he sells are willing and able to help you put your contract on a paying basis.

INTERNATIONAL HARVESTER COMPANY, CHICAGO 1, ILL.

POWER STEERING WITH FULL LOADS mean faster cycles, higher daily production. Because "Big Red" steers with full power on both tracks, it can maneuver with the same heavy loads that can be pulled on the straightaway.

WATCHING BIG RED ROLL Ryan Construction men keep close tabs on the performance of their five TD-24's. Cycles are clocked for half an hour every morning and afternoon. Left to right: Guy Tilley, Job Superintendent, Tom Vickers, Job Foreman, and Virgil Scales, Superintendent.

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Top row — Single Seal — Double Seal — Closeup of Slag in Place.
Bottom row — Travel Mixing of Slag Retread — Typical Plant for Slag Pre-mix.

IN AREAS where it is readily available, crushed slag is an excellent paving aggregate—IF it can be held in place. Slag is porous and holds minute quantities of moisture in its pores.

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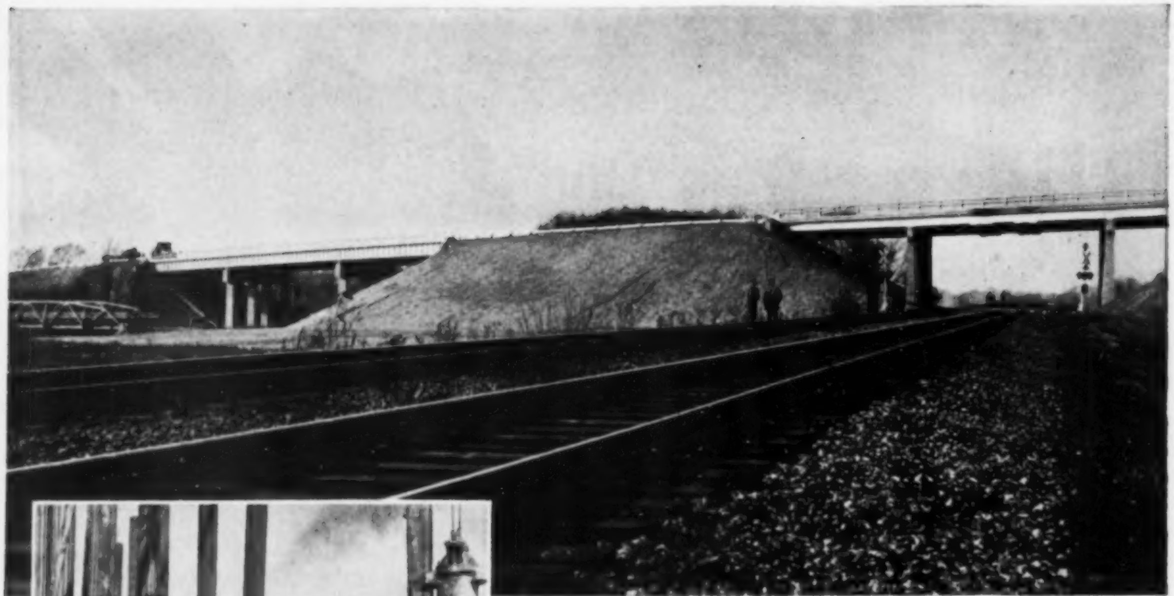

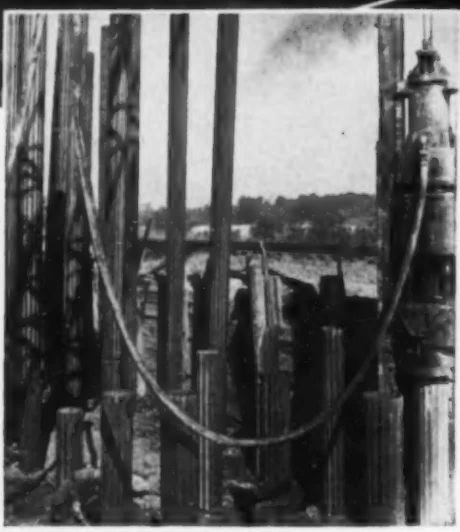

Pile driving and extending under way for Ohio's two new Route 30 bridges (above) engineered by Bureau of Bridges, Ohio State Highway Dept. 286 eighty-foot Monotubes, with 8" tip and 12" butt diameter, were driven. General Contractor: The Lewis and Frisinger Co., Ann Arbor, Mich. Pile Driving Contractor: The Purdy Construction Company, Mansfield, Ohio.

Note the narrowness of this old bridge and the hazardous approach curve which have now been eliminated by Ohio's new Route 30 bridges.

MONOTUBES "go in" for faster, safer traffic and unmatched economy!

THESE new bridges at East Union, Ohio, on the heavily traveled Lincoln Highway, eliminate a triple threat . . . a small bottleneck bridge, a bad curve, and a hazardous railroad crossing. Both bridges are supported by rugged, cold-rolled Monotube foundation piles.

And speaking of eliminating threats, here's another case where Monotubes saved time and money by licking an unexpected problem. The piles had to go much deeper than anticipated, but due to Monotubes' simple field extendibility, the required penetrations were readily achieved using the same light crawler crane with which the job was started—no penalty for heavier equipment.

You stand to gain many other advantages with Monotube piles. Write to The Union Metal Manufacturing Co., Canton 5, Ohio, for Catalog No. 81.

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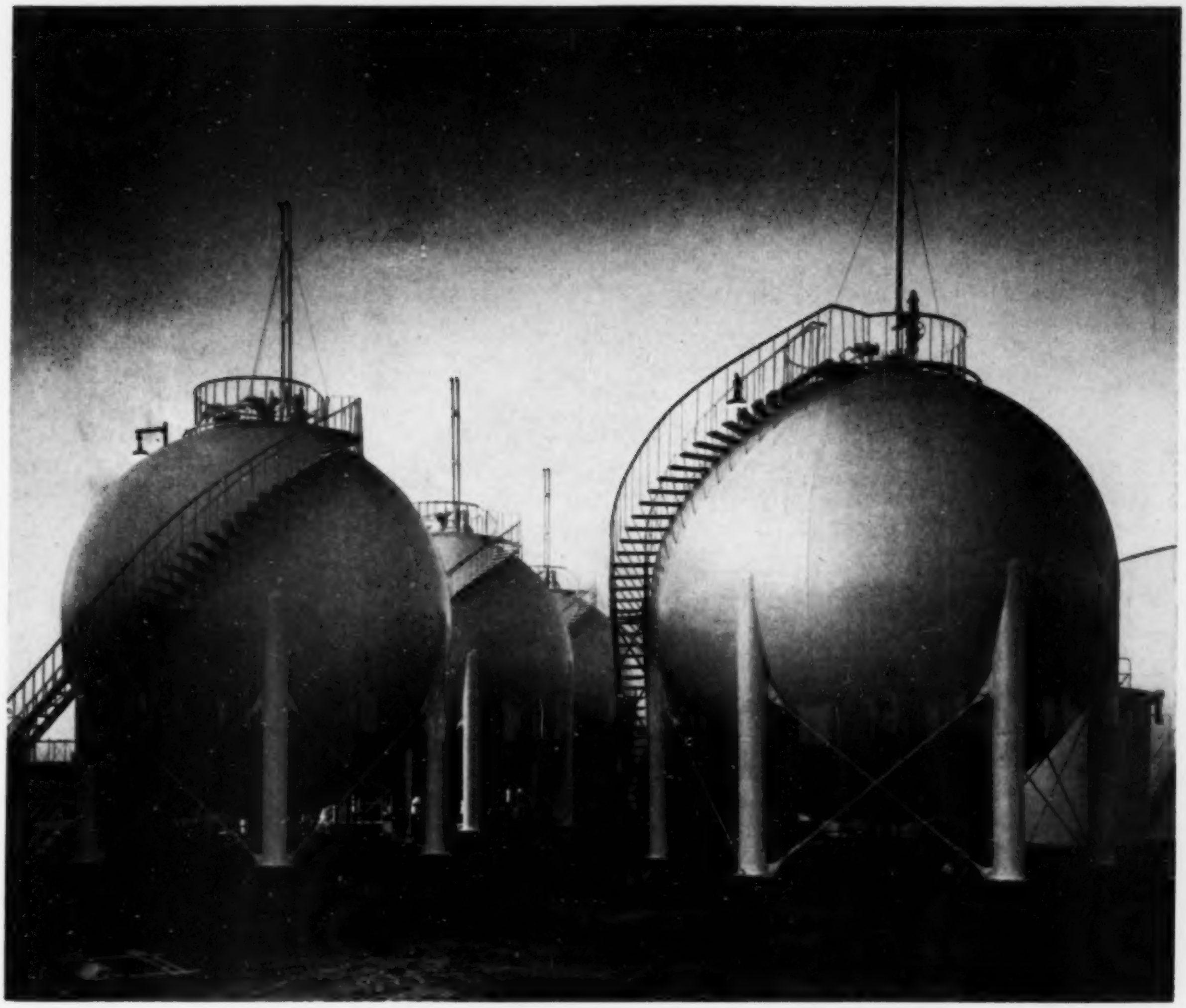
Monotube Foundation Piles



150 lbs. per sq. in. working pressure . . .

. . . is a fairly high pressure for any large container. Construction of such a tank demands careful supervision, skilled craftsmanship . . . and a positive knowledge that specifications are strictly adhered to.

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Chicago Bridge & Iron Company is constantly endeavoring to build better welded steel plate structures. A never-ending search for improved design, fabrication, erection and inspection methods is carried on in an effort to provide all forms of industry with better Horton tanks.

When planning a storage tank, elevated water tank or special steel plate structure to meet any need, write our nearest office for information, estimates or quotations.

Above: The four 29.2 ft. diam. Hortonspheres illustrated above, were built for the Shell Chemical Corporation at their Shell Point plant near Pittsburg, California. They are designed for a working pressure of 150 lbs. per sq. in. and are used for the storage of anhydrous ammonia.

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Los Angeles 17 . . . 1556 Gen. Petroleum Bldg.
New York 6 . . . . . 3395—165 Broadway Bldg.
Philadelphia 3 . . 1652—1700 Walnut St. Bldg.
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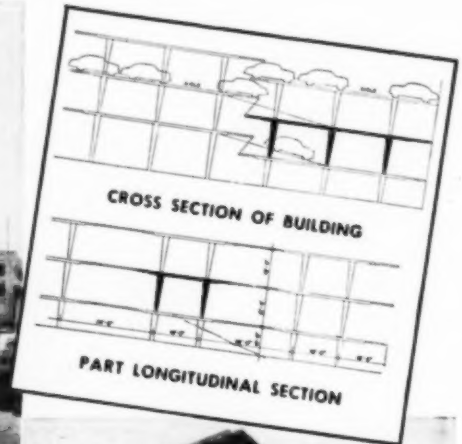

Low-Cost, Open-Deck Garages a Sound Solution of the Downtown Parking Problem

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Built at a cost per parking space considerably below the national average, this New Orleans garage was erected as a series of structures, with half of the 3-story building lapping into the adjacent half, each half consisting of 5 units separated by a flat slab, supported by cantilevers which project to receive the slab which bridges the gap. Identical size of multiple elements permitted maximum economy in form re-use. This open-deck structure, functional as breathing, was concreted throughout with Lone Star Cement, providing an important plus in concrete quality which means extra durability and satisfaction through the years.

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General Contractor: **GERVAIS F. FAVROT & CO.**

Lone Star Ready-Mix Concrete:
JAHNCKE SERVICE, INC.
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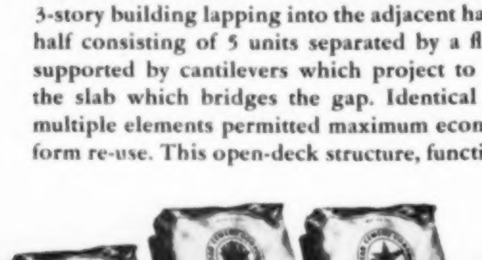

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CIVIL ENGINEERING

SEPTEMBER 1953

THE MAGAZINE OF ENGINEERED CONSTRUCTION

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CIVIL ENGINEERING SEPTEMBER 1953

THE MAGAZINE OF ENGINEERED CONSTRUCTION

Logistics involved in moving materials and equipment to Thule construction site was one of major problems facing builders of air base. From July 15 to September 2, 1951, 150,000 tons of dry cargo and 180,000 tons of bulk fuel were moved across previously undeveloped, 1,000-yd beach. Site was also supplied by air.

Arctic engineering know-how gets acid test at Thule

SAMUEL D. STURGIS, JR.

Major General, U.S. Army
Chief of Engineers

At Thule, in the far north on the west coast of Greenland, the Chief of Engineers of the U. S. Army in December of 1950 accepted the mission of building a modern air base and having it operating by the close of the following construction season, about November 1951. This was project Blue Jay.

So little was known engineering-wise about Thule at the start of the operation that it might almost have qualified as the Ultima Thule of the ancients. In fact its name was derived from the legendary Ultima Thule, or "farthest place," a location of almost inconceivable remoteness. The modern Thule on the west coast of Greenland is approximately at 77° north latitude, less than 900 miles from the North Pole, and about 300 miles nearer the Pole than Point Barrow, Alaska. A person in Thule would have to travel south about a thousand miles as the crow flies to reach Labrador.

Except for a Danish-American weather station and a small Eskimo village from which Perry once launched his polar expeditions, there was literally no development in Thule. Natural resources consisted of rock, a limited amount of fresh water, an unlimited amount of ice, and fish. With the exception of the rock, these were not very promising ingredients out of which to develop an air base. Literally nothing grows here, and the great Greenland icecap, even in the summer season, looks down forbiddingly from a few miles away.

Few had visited the area and no real engineering reconnaissance had ever been made. Knowledge of local soils and materials and of the terrain itself was meager. The only available maps had been prepared from partial coverage by aerial photography.

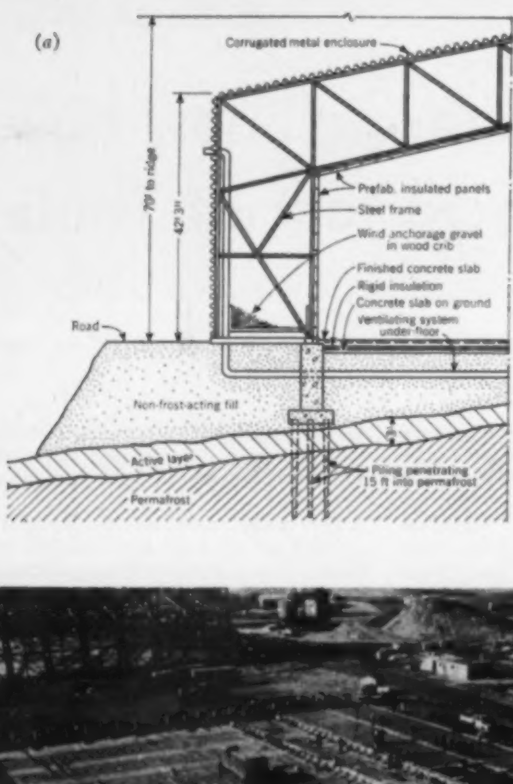
Thanks to the existence of a weather station, considerable information about the weather was available, all of it forbidding. Temperatures were reported as ranging from 50 deg F below zero to 60 deg F above. The site was subject to frequent storms generated by the flow of air from the adjacent icecap. Winds of 35 miles an hour with gusts of 50 to 60 miles were normal, and gusts as high as 125 miles an hour had been reported.

The wide variation in daylight, familiar to all who have served in Alaska, was even more apparent here. At Thule winter brings 52 days of total darkness, while summer affords 112 days of 24-hour daylight.

From the very initiation of studies it became apparent that the problem of landing construction equipment and materials would be the major initial obstacle. This was because it is possible for ships to get through the ice of North Bay, where supplies for Thule must be landed, only about two months of the year, July and August.

The engineering assignment called for the design, procurement of materials, delivery to the site, and construction of a modern air base at this remote location. The construction included runways to carry heavy planes, taxiways, POL storage, hangars to serve the large planes in the coldest of weather, and housing and

Buildings framed in timber stand on pad of non-frost-acting material to insulate frozen subgrade from heat of building. Note short timber columns which permit icy arctic air to circulate between building and foundation.



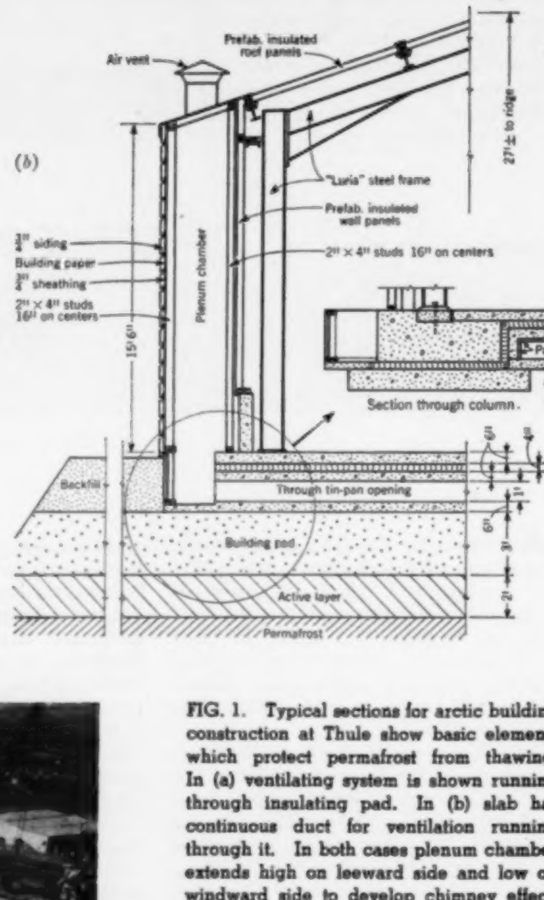


FIG. 1. Typical sections for arctic building construction at Thule show basic elements which protect permafrost from thawing. In (a) ventilating system is shown running through insulating pad. In (b) slab has continuous duct for ventilation running through it. In both cases plenum chamber extends high on leeward side and low on windward side to develop chimney effect.

Hangar floors were poured flush with ground level. Slab rests on insulating pad which contains 12-in. corrugated metal pipes forming cooling system. Pipe inverts are 5 ft 4 in. below finished floor. Reinforced concrete floor contains 4-in. layer of foamglass insulation to reduce rate of heat transfer and provide comfortable floor temperature.

other facilities for the people who must live here while doing all these things.

Over all hung the realization that no substantial amount of construction material or equipment could be delivered before July 1951 and that the base must be in operation some time in November of the same year.

To handle this task the Corps organized a new District, the Northeast District. As architect-engineers, Alfred Hopkins–Metcalfe & Eddy of New York and Boston were selected. A joint venture of Peter Kiewit Sons Co., S. J. Groves and Sons, Condon-Cunningham, and Al Johnson became the construction contractors, organized as the North Atlantic Constructors. Particularly in the early stages, the District received very close supervision and support from the office of the Chief of Engineers. The District subsequently passed to the control of the later organized East Ocean Division.

As the winter of 1950–1951 progressed, designs were developed, materials decided on and ordered, and steps taken to assemble the great fleet which must handle the transportation.

Thule already had a small air strip, a veritable pigmy compared with the giant which was to follow, and to this strip a small reconnaissance force was flown in February of 1951. Under most trying conditions, limited reconnaissance of the area was accomplished, shelter and rations being furnished by the Thule weather station.

A shovel, three D7 dozers, half a dozen dump trucks, wagon drills, and other items of equipment, were air-lifted to the site during this period. This equipment, used primarily to further engineering investigations and to prepare the beaches to the greatest extent possible, proved invaluable in both these respects.

Engineering Problems Involved

The story of the Naval task force, more than a hundred major ships, and of the correspondingly great air lift that supported this operation, is beyond the scope of this article. However, a few statistics give some measure of what was accomplished. Nearly 150,000 tons of dry cargo was discharged between July 15, the day the first cargo crossed the beach, up to September 2, the day the last ship cleared the harbor. In addition, more than 180,000 tons of bulk fuels of various categories were pumped to tanks on shore which, incidentally, had to be built before this operation could start. All this took place across a beach less than a thousand yards long, which at the start of the operation had contained no facilities whatsoever.

The engineering problems related to the site itself were four: (1) Difficulties arising from permafrost conditions; (2) selection of a prefabricated building material that would be suited to arctic conditions, readily produced in the United States, and readily erected at the site; (3) water supply; and (4) construction of the main runway.

Solving the Permafrost Problem

At Thule, foundation designs normally employed were not applicable. The ground is permanently frozen to a known depth of more than 1,000 ft, with an active surface, periodically thawed, with an average thickness of 3 ft. In some places free ice (lenses) makes up as much as 50 per cent of the subsoil. Special designs had to be developed that would insure a stable structure and at the same time prevent heat from thawing the underlying frozen soil and so causing settlement (Fig. 1).

To maintain the thermal balance three different methods were employed: (1) ventilation, (2) insulation, and (3) a combination of the two. At Thule the combination method was used in most cases. Every effort was made to avoid disturbing the permafrost level, and only in rare cases was the active layer stripped off.

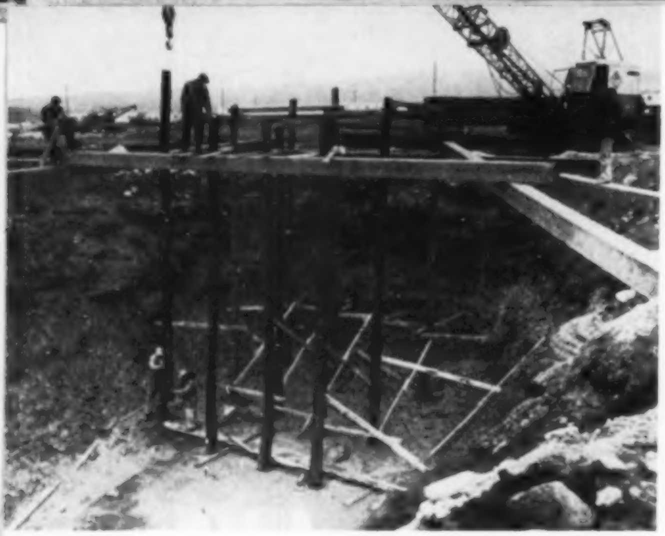
There are no buildings in Thule on foundations designed to maintain the permafrost table, and the thermal balance, by ventilation alone. The nearest approach to this type of design is used for the foundations of boilers, generators and other heavy equipment. For this type of equipment the only suitable foundation is a concrete slab to which the base of the machine can be secured. However, since concrete is one of the poorest insulators, ventilation under the slab is a necessity. To achieve this, slabs are supported on piles sunk into the permafrost a distance equal to at least twice the thickness of the active layer. The slabs themselves are completely above ground, and air circulates freely beneath them. Since the bearing value of frozen ground is high, such piles will support heavy loads and provide vertical stability.

In the design of foundations under buildings framed in timber, definite use was made of the combination method. First a pad of non-frost-acting soil is placed, the depth of the pad varying from 1 to 6 ft, the average being approximately 3 ft. The pad itself is composed of well graded sand and gravel, extended well beyond the building area and sloped off at the edges. The next operation is to place the 12 × 12-in. timber mud sills. These sills are placed at 8-ft intervals, at right angles to the long dimension of the building, and are imbedded 6 in. in the fill. Dwarf timber columns are set on the mud sills and on the top of each column there is $2^1/_2$ in. of plywood packing, or shims, to allow for vertical adjustments during construction and for subsequent adjustment if required. On top of the dwarf columns 6 × 12-in. stringers are installed, parallel with the mud sills and providing supports for the floor panel construction.

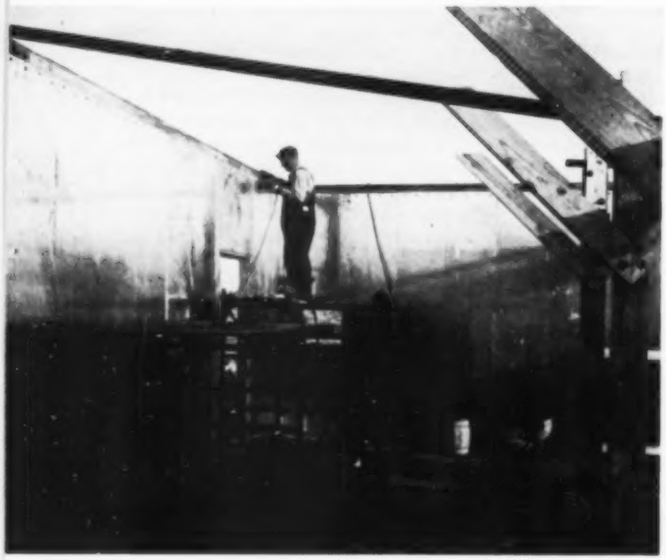
The combination of mud sills, dwarf columns, shims, and stringers raises the building floor approximately 2 ft 9 in. above the top of the non-frost-acting pad, leaving a space through which the outside air can freely circulate. The only contact between the building and the insulating pad is through the timber members, which are poor conductors of heat and around which the cold arctic air is flowing.

Buildings of certain types (such as garages, fire stations and hangars) required concrete floors flush with the adjoining ground. There was no practical way to provide ventilation in the same manner as for the timber structures. Instead, the floor construction itself was made up to contain air channels. For hangars, this consisted in placing, in the fill below the floor slab, a system of ventilation pipes running across the building and connecting into plenum chambers at each side of the building. In other buildings the floor was constructed as a ribbed concrete slab, utilizing conventional tin-pan construction. The pans formed a continuous duct for the flow of air and terminated in plenum chambers at each side. In both cases, the plenum chambers were extended high on the leeward side and low on the windward side for chimney effect to insure circulation of air.

Hangar floors had to be flush with the adjoining ground, and since insulation alone could not prevent heat transfer and resulting thawing of the permafrost foundation, under-floor ventilation was resorted to in the form of corrugated metal pipes of 12-in. diameter, approximately 3 ft on centers, and extending entirely across the hangars in the insulating pad. These pipes are placed with the invert 5 ft 4 in. below the finished floor. The reinforced concrete floor also contains a 4-in. layer of foamglass



Piles are set in open trenches—not driven—because of impenetrable permafrost. After piles are set, excavation is backfilled with gravel, and piles are not loaded until backfill has frozen solid. Note that piles are placed butt down to overcome uplift caused by freezing of active layer.



Prefabricated, aluminum-clad wooden panels, here seen being placed in Building 44, proved to be readily adaptable to arctic construction and could be erected with a minimum of hand labor. Panels consist of 3½ in. of fiberglass insulation sandwiched between two sheets of aluminum-clad, ¼-in. plywood.

insulation to reduce the rate of heat transfer and provide a comfortable floor temperature. Temperature recording instruments have been installed in the floors of these hangars to observe the changes in the thermal balance and for control in the regulation of the under-floor cooling system.

The hangar floors are constructed on a gravel pad of sufficient depth, approximately 9 ft, to limit thawing during the summer season when the under-floor cooling system cannot be operated. When the average outside temperature drops below freezing, the dampers in this cooling system are opened, and air is circulated during the winter to dissipate the heat transferred through the floor and to refreeze the gravel pad and prepare it for the subsequent thawing season.

Piles were driven under the columns and door tracks of hangars. Because they could not be driven into the permafrost, a trench was blasted, the piles placed therein, and the trench backfilled with gravel and allowed to freeze to a solid mass. The uplift created by freezing of the active layer made it necessary to install the timber piles butt down. Loads are not placed on the piling until the soil has had time to refreeze.

Buildings Prefabricated

Use of prefabricated material, if it could be produced rapidly in quantity, shipped economically, erected readily in the Arctic, and if it would meet user demands in the severe climate, appeared very attractive. The ur-

Asphaltic concrete for binding and wearing courses was produced by three 4,000-lb twin pugmill mixing plants, two of which appear below. Crusher in foreground produced fines for aggregate used in wearing course.

gency of the work demanded prefabrication and it was realized that money spent in prefabrication in the United States would save in erection and perhaps shipping costs in the Arctic.

The solution found in this case was an aluminum-sheathed wooden panel. This panel, which had been previously used for the construction of refrigerated spaces, consists of $3^1/_2$ in. of fiberglass insulation sandwiched between two sheets of aluminum-clad $^1/_4$-in. plywood, fabricated for assembly on a 2-ft module. Over two million panels, fabricated within four months, were shipped to the site and erected during the working season of 1951 alone. The panel design selected was readily adaptable to all the various types of structures to be built and could be erected by a minimum of hand labor. An added advantage was that it presented a finished aluminum surface inside and out, which provided a positive vapor barrier, required no finish painting, and would not require periodic maintenance on buildings. With minimum fuel requirements, a comfortable temperature of 72 deg F could be maintained within buildings sheathed in this paneling, even though severe arctic conditions prevailed outside.

Although these Clements panels were employed as lining in the large hangars, and as a basic construction material for all other structures, their standard application is best demonstrated in smaller buildings such as barracks, warehouses, and administrative offices.

Artic Is Arid

Arctic regions in general are arid, and Thule, with an annual precipitation of 2.8 in., is no exception to this rule. This aridity has certain advantages since it makes snow removal from the runway unnecessary and drainage a minor problem, but it does complicate the problem of a fresh-water supply.

When outdoor construction operations were begun at Thule in 1951, the first water supply system established was at Lake Eddy, a small natural lake located between the runway and the north taxiway, and at a distance of about $1^1/_2$ miles from the center of the base. Lake Eddy contains an estimated 70,000,000 gal of water during the summer and around 18,000,000 gal in the winter, when it freezes to a depth of 6 or 7 ft. Water was brought from this lake to the beach through a 6-in. invasion pipe, and an Army water treatment set with a capacity of 50 gal per min was set up near the first temporary Atwell-hut village to supply the water requirements of the men in the base area. This set has operated with complete satisfaction. It continues to supply 50 per cent of the water requirements at Thule.

To supplement Lake Eddy, it was decided to use the sea, and a system of distillation plants was designed for the conversion of sea water to a potable water supply. These plants, three in number, having a combined daily capacity of 129,600 gal in 24 hours, are capable of producing approximately 60 per cent of the normal station demand and are intended as an emergency or supplementary source to back up additional surface sources which might later be developed.

With permafrost extending down 1,000 ft, ground water was not obtainable. Hence a survey was made of lakes in the area. About 6 miles from the base one lake was found which was of adequate depth and could be enlarged by the construction of a moderate-sized earth dam. Crescent Lake, so named because of its shape, has a dependable recharge from surface runoff resulting from melting snow. If necessary, in case of abnormally light precipitation, it can be augmented simply by diverting a stream flowing during the summer from the nearby icecap. Its capacity, which has been enlarged by construction of an earth-fill dam at the south end, is an estimated 160,000,000 gal at a water-surface elevation of 439, while the water volume under 8 ft of ice, exclusive of the bottom 4 ft of lake, amounts to some 60,000,000 gal. It is planned that water, chlorinated and filtered in the treatment plant at the lake, will be transported by a fleet of heated tank trucks to the base, where it will be distributed to storage tanks in each of the buildings equipped for water service.

Installation of a caisson to permit intake of water from the lake below the depth of freeze, and of a pumping system, with chlorination and storage tanks, was begun toward the end of the 1952 outdoor construction season and will be completed as part of the 1953 program. It is anticipated that when the Crescent Lake supply is made available, it will no longer be necessary to continue operation of the salt-water distillation plants, except on an emergency or standby basis. As soon as the Crescent Lake water becomes available, it is planned to discontinue use of water from Lake Eddy, which being in the airfield area is in danger of pollution from accidental gasoline and oil spillage and in addition has had its recharge cut off by airstrip and taxiway construction.

The primary facility at Thule, as at any airfield, is of course the runway system. Here the problem was again permafrost but in addition problems of aggregate classification arose. The design provides a subbase, base course, and surface of non-frost-susceptible material with a minimum thickness of 6 ft. Observations made on the runway during the first season after construction have confirmed the view that a minimum thickness of 6 ft is adequate to confine seasonal thawing to non-frost-susceptible material and to prevent thawing and consequent weakening of the subgrade.

The runway is paved with asphaltic concrete made with asphalt of 120–150 penetration. It was laid in two courses—a $2^1/_2$-in. binder course topped with a $1^1/_2$-in. wearing course—produced by three 4,000-lb twin pugmill mixing plants. The binder course was made from aggregate produced from local stream gravel, using primary and secondary crushers. The wearing course presented a more difficult problem, since this gravel was deficient in fines and hence was unsuitable for the wearing course. Instead, crushed and screened diorite rock from local sources was used. This deficiency of fines in native material is a problem encountered generally in the Arctic, where sufficient fines for aggregate can only be secured by considerable effort.

Thule met its operational deadline of November 1951, and its capability has been steadily expanding since. It has added much to the engineer's knowledge of arctic conditions and to his confidence in what he can accomplish there.

Operation Blue Jay has proved that large-scale construction can be successfully carried on in the far north and has verified theories of construction previously advanced for permanently frozen terrain. It developed a successful pattern for operation of joint Naval, Air, Army, and civilian forces engaged in a major logistic and construction effort. From it we have learned new capabilities in engineering, construction, and management.

Close cooperation between the United States and Denmark was a major factor in the success of the operation. So many different individuals contributed so much to the success of this effort that in this article personal acknowledgments are omitted. However, the whole Blue Jay base stands as an example of what engineers, contractors, construction workers, soldiers, sailors, and airman can accomplish cooperatively under adverse conditions.

Gully stabilization structures check erosion in western Iowa

GUNNAR M. BRUNE, Regional Sedimentation Specialist, Region III, Soil Conservation Service, Milwaukee, Wis.

Gully near Anthon, Iowa, will soon swallow up barn if present rate of growth is maintained. Many gullies in Little Sioux watershed are now 60 ft deep and 200 ft wide and are cutting headward at rate of 100 ft annually.

Typical installations on gully near Mapleton, Iowa, about 7 miles northeast of Croy watershed, show rewards of treatment.

Gulley and sheet erosion in the loess hills of the Missouri Basin are causing the abandonment of farm lands over an area of 25,800 sq miles in Kansas, Nebraska, South Dakota, Minnesota, Iowa, and Missouri (Fig. 1). Many gullies are now 60 ft deep and 200 ft wide and are cutting ahead at the rate of 100 ft a year. Sheet erosion in this area is also severe, frequently removing top soil exceeding 50 tons per acre per year from cultivated land.

This loess hills area is covered with a blanket of wind-blown material, or loess, ranging from 1 to 200 ft in depth. Before settlement by white men around 1870, it was thickly carpeted with prairie grasses. By 1900, ditching and straightening of many of the larger streams had begun, destroying their delicate balance. During World War I, when cultivation of corn and small grain became very intensive, the last of the protective prairie grasses were plowed under or buried by silt from the eroding hillsides.

Gully fingers from the ditched channels began reaching out into the smaller tributaries and draws, and once Nature's equilibrium had been broken down, it was impossible to stop the advance of the gullies with vegetation. Huge trees fell like matchwood in their paths.

Gully 5 in the Croy watershed (part of the Little Sioux watershed), 2 miles northeast of Turin, Iowa, is an example of the rapid advance of erosion (Fig. 2). During the 2.81-year period from July 25, 1948, to May 13, 1951, accurate topographic surveys showed that this gully had grown 0.39 acre (Fig. 2). During this same period, 11.3 acre-ft of sediment was moved out of the gully. This amounts to 4.03 acre-ft per year from the 39-acre drainage area. The annual rate of sediment production is 66.2 acre-ft per sq mile, or 191 tons per acre of drainage area using a dry weight of 85 lb per cu ft, which makes the rates in this area among the highest in the country.

When the numerous short tributaries of the Missouri River emerge on the "big bottoms," the sudden change in gradient causes deposition of a large part of their sediment load. This results in sedimentation in open channels and drains, causing "swamping" of bottom lands and burial of crops. Severe damage to drainage ditches, roads and roadside ditches also occurs. Floodwater damage to crops in small tributary valleys, already severe, is becoming more frequent because of channel deterioration and the bulking effect of sediment in flood waters. Sediment concentrations as high as 27.6 percent by weight have been measured in flood flows in this area.

Deep gullies are isolating and forcing the abandonment of large areas of productive land and making the maintenance of highway bridges very costly. In addition, sheet and gully erosion are removing large quantities of fertile top soil from upland farms, thus persistently stealing away an irreplaceable natural resource.

Remedial Program Undertaken

To improve this situation, the U.S. Department of Agriculture was authorized, in the Flood Control Act of 1944, to carry out a watershed treatment program on 2,720 sq miles of the Little Sioux watershed in western Iowa (Fig. 1). Responsibility for this program was delegated to the Soil Conservation Service, which has developed detailed plans for, and supervised the installation of works designed to control erosion, reduce downstream flood and sediment damage, and increase the agri-

cultural income of the area. This program is in two parts—construction of control structures and land treatment.

The construction part of the watershed treatment program, which is let on a contract basis, includes gully stabilizing structures with concrete notch spillways or chutes, diversion ditches, seeded waterways, and floodwater detention structures. Structures that have been installed in Gully 5 of the Croy watershed are shown in Fig. 3. Most such works are being installed on watersheds of less than 3 sq miles.

Floodwater detention dams, the largest type of structure being provided, involve earth fills of as much as 50,000 cu yd and storage capacities up to 250 acre-ft. About two-thirds of the capacity is usually set aside for temporary flood storage and the remainder is used as a farm water supply and desilting basin. Floodwater is drawn down slowly to the permanent pool level through a fixed-outlet concrete drop box and tube.

Many of the detention and stabilization structures also provide roadways or footbridges across formerly uncrossable gullies. In cases where such structures also serve as highway or railway crossings, the highway agency or railroad concerned contributes toward the cost.

The land treatment part of the program, which is carried out by the landowners, includes terracing, contour cultivation, improved crop rotation, and retirement of the steeper areas from cultivation for use as pasture and woods. The landowners also furnish the land for structure sites and maintain the structures through their soil conservation districts.

In the small watersheds where work has been completed, results have been gratifying. Gully growth and sediment production have been virtually halted and the flooding of these small tributary valleys is no longer a problem. The farmers in the area are completely sold on the work; they realize that with conservation practices their crop yields are higher than ever before. Field studies made since the work began in 1946 indicate that the benefit-cost ratio will certainly exceed the 2.17:1.00 estimate originally made by the Department of Agriculture.

FIG. 1. Watershed treatment program under Soil Conservation Service is controlling gully and sheet erosion on 2,720 sq miles of Little Sioux watershed. Throughout loess hills of Missouri Basin, topsoil is being washed away at rate of 50 tons per acre per year.

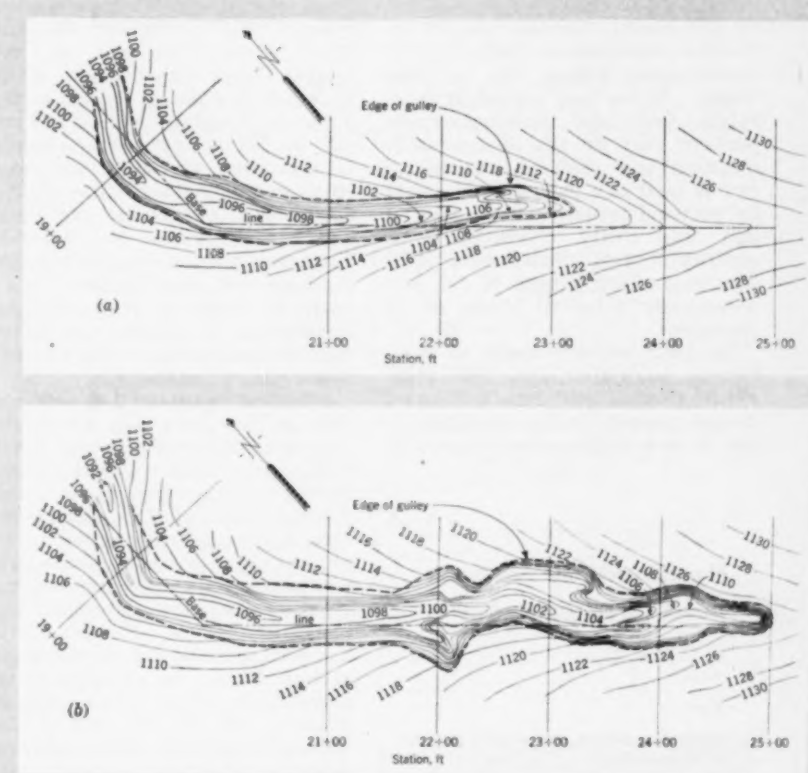


FIG. 2. Topographic surveys of Gully 5, Croy watershed (part of Little Sioux watershed), show rapid gully advance from July 25, 1948 (*a*), to May 13, 1951 (*b*). During this 2.81-year period, gully grew 0.39 acre and 11.3 acre-ft of sediment washed away.

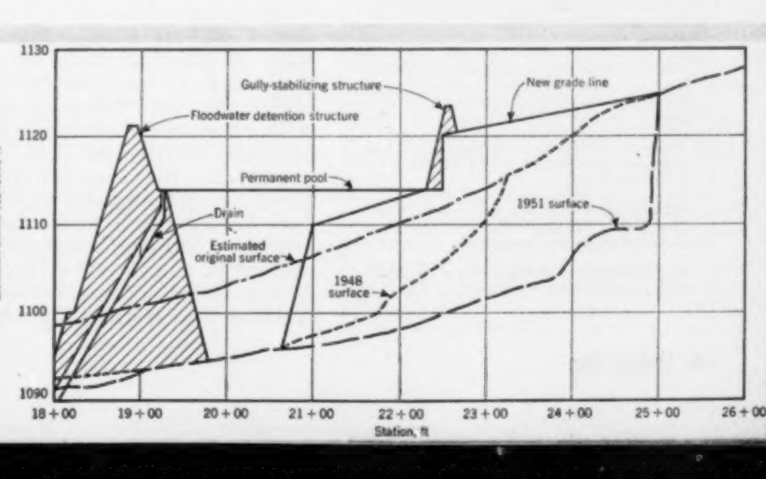


FIG. 3. Installation of erosion control works in Gully 5, Croy watershed, is part of construction phase of watershed treatment program.

Fly ash improves concrete and lowers

A. S. PEARSON, A.M. ASCE, Engineer; **T. R. GALLOWAY, M. ASCE,** Structural Engineer;

Since the early 1930's, the use of fly ash in concrete has been investigated by individuals, by universities, by government agencies, and by industrial organizations (including the Consolidated Edison Co. of New York). It has been proved by laboratory tests and construction experience that fly ash of acceptable chemical and physical composition can be used as a partial replacement for portland cement to make a better and less costly concrete. It is superior to most volcanic ashes in its beneficial effect because of the predominantly spherical shape of its particles.

In 1952, on the basis of satisfactory laboratory and field experience, Consolidated Edison included fly-ash concrete in the specifications for its new construction projects in New York—the Avenue A Substation, Manhattan; the new Unit No. 7 at the East River Generating Station, 14th Street and the East River, Manhattan; and the new Astoria Generating Station, on the East River in Astoria. Since the New York City building code did not provide for the use of fly ash in concrete at that time, special permits were obtained on a trial basis from the city departments of Housing and Buildings and of Marine and Aviation. The services of an independent testing laboratory were retained and a program of rigid quality control was established in which appropriate ASTM Standards governed wherever applicable. (See Fig. 1.)

The first commercial fly-ash concrete in New York City was poured on July 1, 1952, at the Avenue A Substation. Since then, a total of 18,000 cu yd have been poured at the Avenue A Substation and at the Astoria and East River generating stations. Fly ash was also used in the gunite lining for the two stacks, floor topping, and grout for equipment and column base plates at Astoria. Fly-ash mortar has been specified for the brickwork at East River. In all cases, fly ash replaces 20 percent of the portland cement. All fly ash used in Consolidated Edison Co. work is obtained from the Waterside Generating Station at 38th Street and the East River, Manhattan.

New York City Permits Use of Fly Ash

Local Laws Nos. 83 and 84, which relate to the use of fly ash in controlled concrete in New York City, were adopted on May 19, 1953. Local Law No. 83 defines fly ash as the "residue from burning pulverized coal in suspension which is separated and collected from the gases of combustion after they leave the furnace." Local Law No. 84 states that fly ash may be used as a replacement for sand or portland cement in the amount of 20 percent of the weight of this cement in controlled concrete. This law also specifies the following limitations with respect to specific surface and fly-ash components:

Specific surface	minimum of 3,000 sq centimeters per gram
Silicon dioxide	minimum of 35 percent
Aluminum oxide	minimum of 15 percent
Magnesium oxide	maximum of 3 percent
Carbon	maximum of 12 percent

Fly ash results from burning coal which has been pulverized to such fineness that about 80 percent passes the 200-mesh sieve. This fuel is blown into the furnace with the primary air, and combustion of the coal particles occurs almost instantly while they are suspended in space. The ash forms as minute, molten globules at approximately 2,800 deg F, which congeal into spherical particles as they leave the high-temperature furnace region. After the ash passes through the superheater, economizer and air preheater, it is separated and collected from the gas stream by an electrostatic precipitator, or a mechanical collector plus an electrostatic precipitator in series.

Fly ash, as it comes out of the collecting equipment, is a gray powdery substance of such fineness that usually 100 percent passes the 60-mesh sieve and over 80 percent passes the 325-mesh sieve. The particles passing a 325-mesh sieve range downward in size to sub-micron, or less than 1/25,000 in. The first combination pulverized-coal boiler and electrostatic precipitator was installed in Detroit in 1924 by the Detroit Edison Co., and it was at that time that fly ash, as defined in New York City's Local Law No. 83, first came into existence. The first installation in New York City of a pulverized-coal boiler, together with an electrostatic precipitator, was made at Consolidated Edison's East River Station in 1929.

Even though fly ash is of relatively recent origin, it is very similar to the volcanic ash which was first used as a cementing material over 2,000 years ago. This predecessor of fly ash, together with calcined limestone, was the principal ingredient of the hydraulic cement used to build such enduring Roman structures as the

Fly-ash activity analyzed

Concrete mix, per cu yd of concrete:

Portland cement	485 lb
Waterside fly ash	121 lb
Sand	1,315 lb
Stone	1,890 lb
Water	36.8 gal

Chemical reactions summarized, per cu yd of concrete:

50.2 lb of silicon dioxide (SiO_2) and 31.7 lb of aluminum oxide (Al_2O_3) in fly ash combined with 108.1 lb of hydrated lime liberated during hydration of cement to produce 163.8 lb of cementing compounds ($CaSiO_3$ and $2CaO.Al_2O_3$)

Effective cementing compounds in fly-ash concentrate after 8 months = 570.4 lb (485 lb of portland cement minus 78.4 lb of free lime plus 163.8 lb of $CaSiO_3$ and $2CaO.Al_2O_3$)

Effective cementing compounds in regular portland cement concrete = 508.0 lb (606 lb of portland cement minus 98 lb of free lime)

Out of 121 lb of fly ash, 85.3 lb took part in chemical reactions and 35.7 lb became beneficial fines in mix.

103.6 lb of useless and harmful hydrated lime from portland cement was converted to useful cementing compounds.

26.2 lb of additional water became available later for hydration of cement.

its cost

Consolidated Edison Co. of New York, Inc., New York, N.Y.

New Astoria (New York) Generating Station of Consolidated Edison reflects company's confidence in fly-ash concrete, which was used in this structure. It is now standard practice to specify this concrete on all of company's work.

Appian Way and the Aqueduct of Claudius (312 B.C.), the Colosseum (80 A.D.), and the Pantheon (120 A.D.). From this period in ancient Roman history until the arrival of portland cement in 1824, volcanic ash and calcined limestone remained the basic cementing materials for ordinary and hydraulic construction. Volcanic ash is still used in Europe with portland cement where severe alkali and sulfate-bearing waters are present.

Fly-Ash Characteristics Examined

Existing literature reports the results of many investigations in which the characteristics of fly-ash concrete have been examined. A number of references are given in the accompanying bibliography (at end of article). It has been found that the properties of concrete are benefited by the inclusion of fly ash in the mix.

Some of the beneficial effects of fly ash derive from its physical characteristics. The fineness and spherical shape of the particles improve the fresh and hardened concrete in many ways. A sort of ball-bearing action causes concrete to flow more easily in chutes and forms. It vibrates more readily and there is less segregation, bleeding, and laitance. Formed surfaces are smoother, and there is an absence of voids and honeycombing. The rebound of sand and cement, which has always been considered a necessary evil in gunite work, is markedly reduced with fly ash.

Other beneficial effects are due to chemical changes (see box). Fly-ash activity depends on four factors; (1) the presence of amorphous oxides of silicon and aluminum in the amount of about 70 percent of the fly ash, (2) the extreme fineness of the ash, (3) the presence of large quantities of free lime liberated during the hydration of portland cement, and (4) a chemical action between amorphous silicon and aluminum oxides and hydrated lime, which results in additional cement compounds. As a result of these chemical changes, fly-ash concrete is superior to ordinary concrete with respect to compressive, tensile, flexural and bond strength; moduli of rupture and elasticity; volume change; durability; watertightness; plastic flow; and resistance to acids, alkalies and sulfates. This type of concrete is particularly effective in resisting the attack of sea water. Because of the reduction in the amount of portland cement, since some is replaced by the fly ash, there is less heat of hydration and consequently less expansion and subsequent shrinkage of the hardened concrete.

Hydrated lime is an inherent component of hardened portland cement which appears in major amounts during the formation of tricalcium silicate and in minor amounts during the formation of dicalcium silicate.

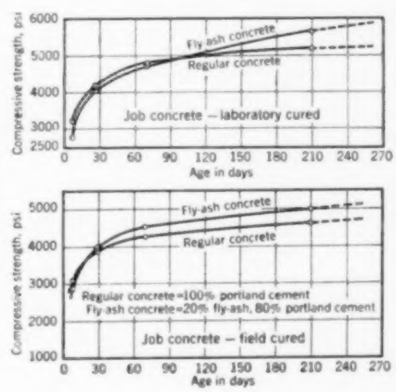
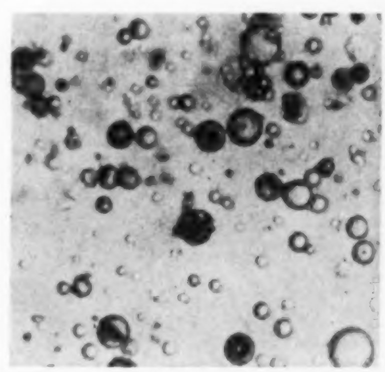
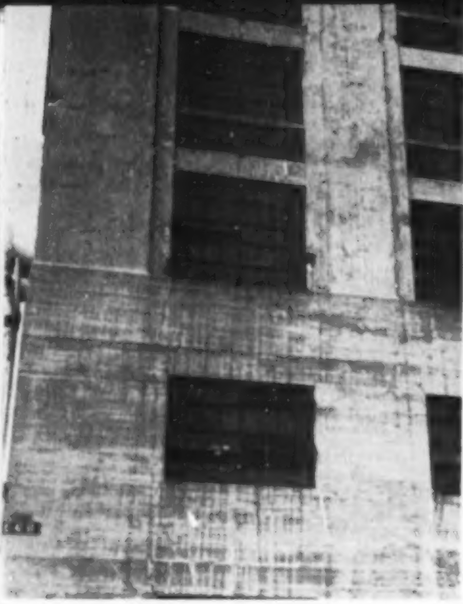


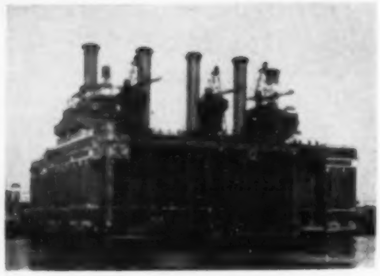
FIG. 1. Tests of job concrete were made in connection with first commercial pouring of fly-ash concrete in New York City, July 1, 1952, at Avenue A Substation of Consolidated Edison. Tests of 3,000-psi controlled concrete made on 6 × 12-in. cylinders at United States Testing Company laboratory, showed compressive strengths plotted here. Average 28-day strength of 59 test cylinders of fly-ash concrete, representing 1,300 cu yd, was 3,619 psi.



Spherical shape of particles, shown in photomicrograph of Waterside fly ash, makes fly ash superior to most volcanic ashes for use in concrete. Particles range in size down to less than 1/25,000 in., and 80 percent pass 325-mesh sieve.



Ten-story reinforced-concrete service building of Consolidated Edison, built in 1923, requires continuous maintenance to patch and repair damaged surfaces. Cracking and spalling are believed due to shrinkage caused by carbonation of calcium hydroxide.



Foundations of Consolidated Edison's Hell Gate Generating Station have grown 1½ in. upward and 1½ in. laterally since station was built in 1920, causing equipment outages and requiring realignment of turbogenerators and other costly repairs. Tests indicate that cause is combination of magnesium sulfate in sea water with hydrated lime in portland cement concrete.

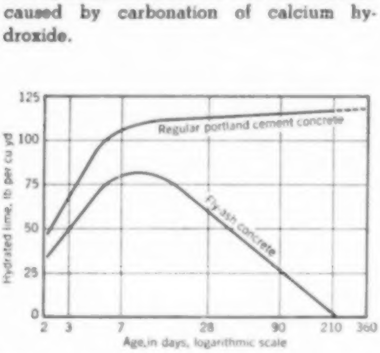
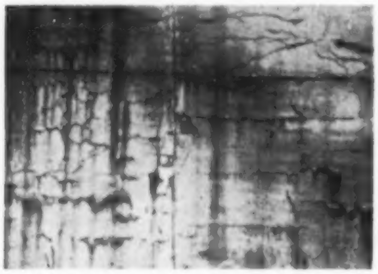


FIG. 2. Hydrated lime in 6 × 12-in. cylinders of job concrete with and without fly ash was determined at Consolidated Edison laboratory, with results shown. Average of 64 tests of regular portland cement concrete at age of 90 days was 115 lb of hydrated lime per cu yd, equivalent to about 18 lb per bag of portland cement.



This is an example of carbonated hydrated lime efflorescence and typical shrinkage and surface cracking due to reaction between hydrated lime in concrete and carbon dioxide in atmosphere. Tests indicate that this surface concrete contains 482 lb of calcium carbonate per cu yd.

The average content of hydrated lime per cubic yard of regular portland cement job concrete, as determined by 64 tests for free calcium oxide in accordance with ASTM Designation C114-47, Section 31, was 115 lb, equivalent to an average of 18 lb per bag of portland cement.

According to test data, most of the hydrated lime appears during the first seven days (Fig. 2). This substance occupies valuable space and apparently does not contribute to any of the desirable properties of concrete. If ordinary portland cement concrete had been used at the Avenue A Substation and the Astoria and East River generating stations, instead of fly-ash concrete, these structures would now contain a total of 1,000 tons of hydrated lime. When 20 percent of the portland cement in concrete is replaced with fly ash there is an immediate reduction in the hydrated lime of 20 percent and only an insignificant amount remains in the concrete after seven months.

Free calcium hydroxide is slightly soluble in water and leaches out of ordinary portland cement concrete through cracks, construction joints, and connecting voids. As the lime comes to the surface, it combines with atmospheric carbon dioxide to form calcium carbonate, which adheres to the face of the structure. This hard, white efflorescence can be seen on almost any retaining wall, bridge abutment, or other concrete structure where a hydrostatic pressure exists on the opposite side. This process starts soon after the concrete is poured and continues for decades. A similar deposit is commonly seen on the face of brick and stone masonry. Besides the unsightly appearance of these white incrustations, the leaching of solid components out of the mass impairs the quality of the concrete and mortar with respect to strength, watertightness, durability, and resistance to aggressive acid, alkali and sulfate waters.

The presence of free calcium hydroxide in hardened concrete makes it vulnerable to destructive chemical attack. This subject has been explored by recognized authorities, (see bibliography at end of article) from two of which the following quotations are taken.

According to the Bureau of Reclamation's *Concrete Manual:*

"Most prominent among aggressive substances which affect Bureau concrete structures are the sulfates of sodium, magnesium and calcium. The sulfates react chemically with the hydrated lime and hydrated calcium aluminate in the cement paste to form calcium sulfate and calcium sulfo-aluminate respectively, these reactions being accompanied by considerable expansion and disruption of the paste."

According to Lea and Desch:

"When magnesium sulfate is present, lime reacts with it forming magnesium hydroxide and calcium sulfate. The attack on set cement products by sulfate solutions is accompanied by a marked expansion consequent upon the formation of calcium sulpho-aluminate and gypsum crystals; disruption of the mortar or concrete results. The chemical action of sea water is mainly due to the presence of magnesium sulfate—magnesium sulfate reacts with calcium hydroxide in set portland cement to form calcium sulfate, at the same time precipitating magnesium hydroxide. Concrete which has suffered attack by sea water contains within it products of the action—includes calcium sulfate, calcium sulfo-aluminate and magnesium hydroxide."

Lea and Desch also state that atmospheric carbon dioxide combines with free calcium hydroxide in hardened concrete to form calcium carbonate, a reaction which is accompanied by shrinkage and surface cracking.

The presence of calcium hydroxide in the mortar of brick stacks and of brick lining in steel stacks is responsible for much of the damage and expensive periodic repairs required on these structures. Sulfur dioxide and, to a lesser extent, sulfur trioxide, which are present in combustion gases, combine with condensate or moisture from rainfall to produce sulfur acids. The chemical union of the sulfur acids, calcium hydroxide, and

the hydrated cement aluminates in the brick mortar yields calcium sulfate and calcium sulfo-aluminate. Both compounds occupy more space than the original calcium hydroxide, causing the brickwork to crack and fissure. In samples of mortar taken from damaged brickwork at the top of one of Consolidated Edison's stacks, calcium and other sulfates were present in the amount of 15.15 lb per 100 lb of mortar.

Growth of Concrete Foundations

An example of the injurious effect of chemical action in concrete has occurred in the foundations of the Hell Gate Generating Station, which have grown upward and laterally about $1^1/_2$ in. in both directions during the 33 years since they were poured. The active components in this case are magnesium sulfate (supplied by the sea water in the discharge tunnel) and hydrated lime (in the concrete). The discharge tunnel runs the full length of the station and is contiguous with the affected concrete. Analyses of samples taken from the expanding concrete foundations below the elevation of high tide revealed the presence of excessive amounts of calcium sulfo-aluminate and magnesium hydroxide. Three specimens of this concrete contained an average of 299 lb of calcium sulfo-aluminate and 235 lb of magnesium hydroxide per cu yd. According to Lea and Desch, previously quoted, the formation of these compounds is accompanied by expansion. Samples of concrete taken from the foundations above high-tide level, contained only minor quantities of these compounds.

It is apparent that the growth of the Hell Gate Station foundations is due to the formation of large quantities of calcium sulfo-aluminate and magnesium hydroxide. The growth of these foundations has cost the company thousands of dollars in unscheduled equipment outages, realignment of turbo-generators, and repairs to broken circulating water pipes and cracked masonry. According to tests, if fly-ash concrete had been used in these foundations, the vulnerable calcium hydroxide would have been reduced 20 percent immediately after placement, and completely depleted several months after construction. Without the presence of hydrated lime, the expansive chemical changes could not have occurred.

The conditions associated with the growth of the Hell Gate foundations are almost identical with those connected with the growth of a dry dock in the New York area built in 1942, which after ten years had expanded 12 in. in its length of 1,100 ft. In this case, as at Hell Gate, sea water is in intimate contact with the affected concrete.

A ten-story reinforced concrete service building of the company in Manhattan has developed countless surface cracks since it was built in 1923. Continuous maintenance work has been required to remove pieces of spalled concrete and patch and repair the damaged surfaces. Periodic stability surveys have been made through the years and no settlement has been recorded. Samples of concrete which were taken from the structure and tested, contained calcium carbonate in the amount of 151 lb per cu yd. Including the hydrated lime still present, this concrete contained about 117 lb of hydrated lime per cu yd before carbonation. Considering that the carbonation of calcium hydroxide is accompanied by shrinking, as Lea and Desch state, this phenomenon may account for the cracked and spalled condition of the building.

The superiority of fly-ash concrete compared with ordinary portland cement concrete with respect to chemical resistance and other properties has been reported by the Sanitary District of Chicago in an article by W. T. McClenahan in *Engineering News-Record*, March 12, 1953, the Halliburton Oil Well Cementing Co., Scholer and Smith, Robert Blanks, and D. D. Langan (see bibliography at end of this article). Charles H. Scholer, professor and head of the Department of Applied Mechanics at Kansas State College, was awarded the ACI Wason Medal, with Gerald M. Smith, for "noteworthy research" (see bibliography).

On the basis of the test results and job experience here outlined, the structural engineers of Consolidated Edison consider it sound engineering practice to include fly ash whenever portland cement is used. It is now standard practice to specify fly ash to replace 20 percent of the portland cement in all concrete, mortar, gunite, floor topping and grout used on the company's work.

According to prices quoted in New York City, fly-ash cement, containing 20 percent fly ash and 80 percent portland cement, costs 11.5 percent less than regular portland cement.

Chemical and petrographic analyses of concrete samples were made at the Astoria Chemistry Laboratory of Consolidated Edison under the direction of Alfred C. Muller and Herbert Lape. Laboratory work in connection with fly-ash activity in concrete is being carried on by the Test Bureau of Consolidated Edison under the supervision of Harry Goulding and Joseph Cifuentis. Laboratory work concerning the identification of cement compounds by means of X-ray diffraction analysis is in progress at the Polytechnic Institute of Brooklyn, under the supervision of Prof. I. Fankuchen. All of this work has been conducted under the general direction of L. B. Bonnett, vice-president in charge of engineering, and G. R. Milne, mechanical engineer.

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Special portals for outlet tunnels

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Eight tunnels in the right abutment comprise the outlet works at Garrison Dam, now under construction by the Corps of Engineers on the Missouri River in central North Dakota, and one of the three largest earth-fill dams in the world. Tunnels 1 through 5 are power tunnels 29 ft in finished diameter. Tunnels 6, 7 and 8 are slightly smaller to serve for river regulation and discharge into a stilling basin. All the tunnels are some 1,200 ft long between portals. The general layout, well described by J. S. Seybold, M. ASCE (Civil Engineering, October 1949, p. 28), is shown in Figs. 1 and 2. A profile of one of the power tunnels, No. 4, is given in Fig. 1.

Principally because of the high cost of the terminal structures (the intake at the upstream end, and the powerhouse, surge tanks and stilling basin at the downstream end), comparative studies showed that economy would be secured by minimizing the tunnel spacing and length. Therefore a minimum tunnel spacing of two diameters was selected, and it was specified that any one tunnel should be excavated and concreted before the adjacent tunnels were mined—at least to the extent that mining was not allowed to approach closer than 75 ft to concrete in an adjacent tunnel which had aged less than 21 days.

The terminal excavations and tunnels were constructed in the Fort Union formation, which is a clay-shale of the early Tertiary period, that is, a relatively young formation. The shale is not cemented and owes its strength mainly to compaction under the load of former overburden, of the order of 1,000 ft of material as shown both by geologic evidence and by laboratory tests indicating preconsolidation loads of 80 to 100 tons per sq ft. The formation is largely clay, although it varies widely from beds of fine sand to those of fat clay. The sand beds are usually water bearing, as are also the numerous beds of lignite coal, the latter highly pervious because of their open joints.

The formation is relatively strong, as shown by the steep bluffs along the valley wall up to 250 ft high, and the design shear strength was determined from a slope chart obtained by surveying these natural bluff slopes and computing strength for both stable slopes and those which showed old failures. This resulted in a design shear strength of 0.7 tons per sq ft as a no-load strength ("cohesion") and a friction angle of 20 deg. The derivation of this slope chart and other design properties for the Fort Union formation have been described by C K. Smith, A.M. ASCE, and J. F. Redlinger ("Soil Properties of Fort Union Clay-Shale", Proceedings, Third International Conference on Soil Mechanics and Foundation Engineering, Switzerland, 1953).

Slope Stability Problem

To shorten the tunnels, the design employed a relatively steep temporary slope over the downstream portals, with backfill used both to flatten the final slope and to effect drainage of the lignite and sand layers (Fig. 1). This downstream slope consisted of approximately a 1 on 1 slope about 150 ft high, with berms at the lignite layers to catch seepage, and a slightly flatter slope at the top through the sand layer.

Stability was analyzed by May's method of differential slices (Fig. 3) and showed a factor of safety of 1.15 with seepage forces essentially horizontal (termed the case of adverse seepage), which would be a possible condition for water draining out of the slope following an instantaneous excavation. As the excavation neared completion, exposing the lignites, the seepage forces would tend to be directed vertically downward to the lignites, which would then act as

Downstream portals of outlet tunnels for Garrison Dam are seen in various stages of completion. Close spacing of tunnels was adopted to secure economy in relatively expensive terminal structures.

maintain slope stability at Garrison Dam

Fig. 1. Longitudinal profile shows Garrison Dam, a typical power tunnel (No. 4), and underlying geological strata.

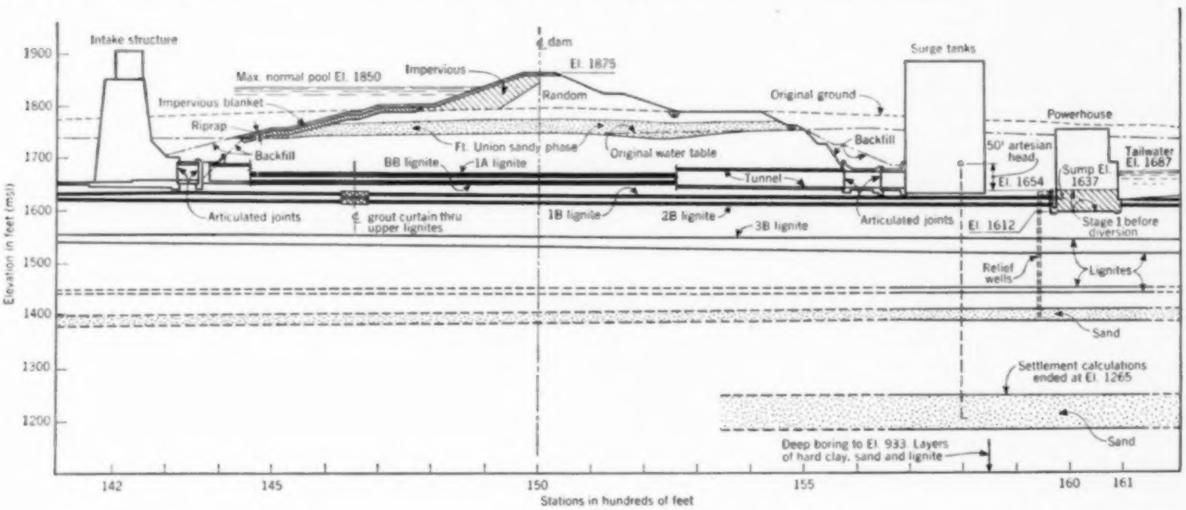
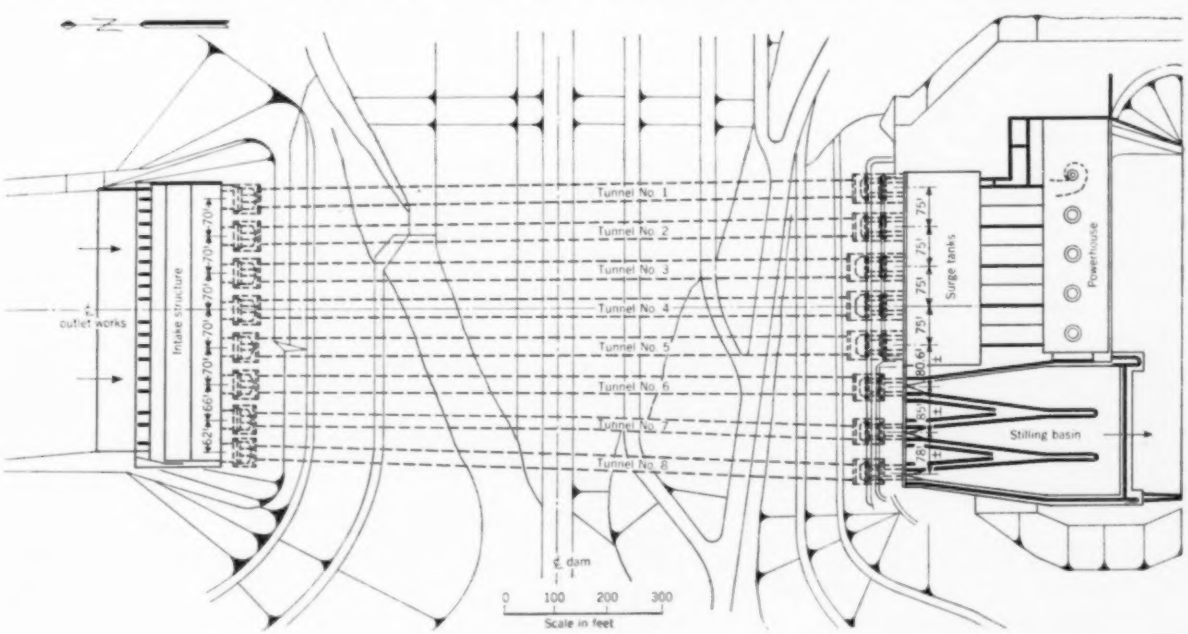


Fig. 2. In outlet works, Tunnels 1–5 are for power, and 6, 7, 8 are for river regulation and discharge into stilling basin.



internal drains. This was termed the case of favorable seepage and gave a factor of safety of 1.35. The best estimate of the safety factor at the time the tunneling would start (about 1 1/2 years after completion of the excavation) was considered to lie between these limits and somewhat nearer the higher value for the case of favorable seepage. Hence, for comparative purposes, the values of the safety factor given below are for this upper limit, or favorable seepage, except as specially noted.

Mining the tunnels as holes would reduce the stability of the slope by removing strength across the hole. Assuming the tunnel hole to be square for simplicity, the resulting safety factor would be 0.61 directly over a tunnel (Case II A) and an initial value of 1.35 between tunnels (Case I), both cases being for a two-dimensional analysis (Fig. 3). With alternate tunnels mined, the load would actually arch around the tunnel holes, so that the overall factor of safety was calculated by summing up the total resistance and the total overturning moment on the failure surface from the center of one tunnel to the center of the next alternate tunnel, thus representing a unit length of a much longer slope containing many tunnels. When so analyzed for an overall safety factor, the treatment of individual lengths of slope by two-dimensional analysis becomes an admissible procedure.

As shown in Fig. 3, this resulted in an overall safety factor of 1.18 for the downstream slope for Case II B, with alternate tunnels mined as holes. Since less favorable seepage would reduce the stability to some value between this and 1.0, it was considered that portal structures were definitely needed to compensate for the loss of stability on this important slope during mining of the tunnels.

Studies for Portal Design

Several types of portals were studied and their effect on slope stability analyzed. The type adopted, shown in Fig. 4, serves to react against the slope as a buttress and also to force any sliding surface to go deeper in passing beneath the portal. Pressure from the slope is taken on a collar slab and transferred to the main shear key. These two parts of the portal were required to be poured first, after only a small excavation into the toe of the slope. The entire buttress section of the portal was required to be completed, and thus able to take load from the slope, before its strength was unduly reduced by excavation of the tunnel as a hole.

To maintain a stability factor of 1.3 over the portal with the tunnel excavated, analysis indicated that the portal should afford a resistance to the slope of 4,600 tons. The portal shear key was designed for substantially the same safety against sliding, as indicated in Fig. 4. With this result, combined with the initial safety factor of 1.35 between tunnels, the overall safety factor was then 1.33 when computed by the method of Fig. 3, with portals built and mining completed on alternate tunnels. This was considered an adequate portal contribution for the objective of maintaining essentially the original stability of the slope during tunnel construction.

Similarly, a step-by-step study was made of stability during various stages of portal construction and tunneling. Except for a temporary drop to about 1.28 during excavation at alternate portals for the collar slab and shear key, the overall safety factor was computed in the range of 1.3 to 1.35 as construction was carried out on the portals and followed by mining of the tunnels. The final step in tunnel construction was installation of the concrete lining which, with its longitudinal reinforcement able to take tension, effected a considerable increase in stability. Subsequently, during construction of the powerhouse foundation, an excavation about 10 ft deep was required in front of the portals for the surge-tank foundation. This would tend to drop the safety factor back again to its original value of 1.35. However, such a drop in stability was avoided prior to this excavation by placing backfill to the top of the portal walls to act as a counterweight.

Since it was not essential for stability, the outer or barrel section of the portal was poured later, and generally after the tunneling was well along. The principal function of this

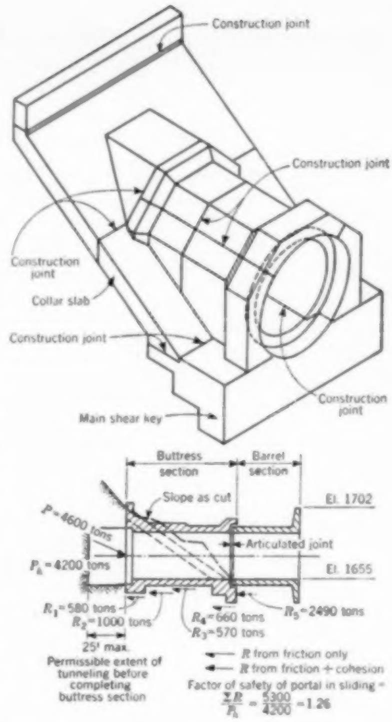


Fig. 4. Isometric view (above) indicates adopted design for buttress section at tunnel portals to improve stability against sliding. Portal affords resistance to slope of 4,600 tons as shown by lower diagram.

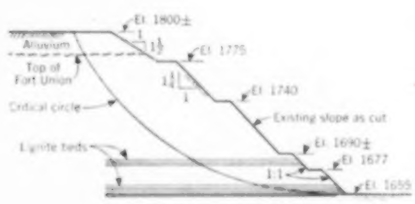
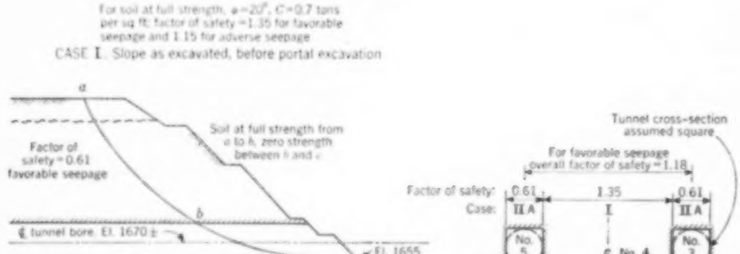


Fig. 3. Downstream slope at tunnel portals was made about 1 on 1, with berms at lignite layers, to secure minimum tunnel length.



portion was for articulation to accommodate the substantial movements estimated. Since the portals would be subjected to some torsion from the usual dish-shaped settlement of the major structures adjacent, the type of joint adopted was essentially a large bell-and-spigot, with one joint used between the two portal sections and another between the portal and the tunnel. As reported by S. J. Occhipinti, J.M. ASCE, and the writer ("Rebound Gages Check Movement Analysis at Garrison Dam," Proceedings of Third International Conference on Soil Mechanics and Foundation Engineering, Switzerland, 1953), these estimated movements have to a large degree been confirmed by observations. Rebounds up to 2 ft have already been measured as a result of unloading by removal of around 175 ft of excavation.

At the upstream portals, the safety factor was significantly greater than at the downstream portals because of the flatter 1 on 4 slope below the dam (as designed for a drawdown condition) and the lesser height of the temporary 1 on 1 slope, which was here only about 90 ft high, cut into the main slope at the portals (Fig. 1). Here the same general type of portal design was used but with a considerably lighter section, comprising only the buttress portion of the portal. A separate transition section was used to span between the portal and the intake structure, with articulated joints at each of its ends to accommodate movement.

Construction Experience

The portals and tunnels were successfully constructed from 1949 to 1951. The portals functioned as designed except that the top parapet wall was insufficiently high to catch local sloughing on the downstream slope. This deficiency was remedied by using temporary sheeting to project somewhat higher. Except for these surface sloughs up to 8 ft deep, which were caused mainly by seepage from the lignite strata above the portals, the Fort Union formation stood up very well and permitted vertical excavation for the portals as well as full-face excavation at the headings in the tunnels, which were mined for their full length before concreting.

As experience accumulated, some temporary departures from the initial schedule of steps in portal construction were permitted for brief periods where analysis indicated that the safety factor for short lengths of slope would not be likely to drop below about 1.25 for the favorable seepage case (1.05 for the case of adverse seepage). The slopes were carefully watched for movement, and some cracking occurred on the downstream slope at the back of the El. 1775 berm. Also, observations for lateral yield were taken on this slope which showed up to around 6 in. of horizontal movement, although it is possible that part of this movement was due to the horizontal component of rebound resulting from unloading by the downstream excavation. From these observations and the successful construction experience, it was apparent that the downstream-slope design, as strengthened by the portals, was adequate but not overconservative.

The actual mining and concreting of the tunnels progressed rapidly. However, at times it was threatened with delays from the portal work, which was started relatively late and required considerable time for construction. Hence, as a hindsight comment based on this experience and representing only the writer's personal opinion (although shared by others connected with the work), it is stated that if the work were to be repeated, the writer would favor consideration of a flatter temporary slope and resulting slightly longer tunnels, with less massive portals, as likely to expedite the tunneling work and offer at least some cost saving, in addition to reducing the risk of a slope failure.

Personnel primarily responsible for developing this type of portal design included R. H. Hayes, as chief of the Engineering Division; R. D. Field, M. ASCE, as chief of the Design Branch; H. F. Michel, A.M. ASCE, as head of the Structural Section; and, as foundation engineers, the writer, assisted by C. K. Smith, A.M. ASCE, head of the Soils Design Section, and S. J. Occhipinti, J.M. ASCE—all of the Garrison District, Corps of Engineers. The contract for the tunnels and portals was executed by the S. A. Healy Company and administered for the Corps of Engineers by J. W. Sibert as chief of the Construction Division, and by E. L. Knutson and A. F. Arrington serving in turn as resident engineer.

How would you do it?

Some of the most fascinating chapters in the life and memory of an engineer are those which deal with the unusual and unexpected situations which almost got him down but from which he finally emerged the victor.—H. J. Gilkey

During the recent construction of an overhead-crane runway for the Booth-Kelly Lumber Company's Springfield, Ore., mill, Bethlehem Pacific Steel's erection crew ran into an engineering problem. The overhead-crane runway was to be used for unloading logs from railroad cars and trucks and lowering them into a stream where they were to be floated to the mill's log pond. The problem was to place the two $13^1/_4$-ton steel girders across the 60-ft-wide stream at the end of the runway.

Available equipment consisted of a 15-ton truck crane that could handle $12^1/_2$ tons at a 12-ft radius with a 50-ft boom, and a 20-ton truck crane capable of handling $12^1/_2$ tons at a 15-ft radius. The 20-ton crane could not boom out far enough with the 60-ft girder to permit the 15-ton crane, on the opposite bank, to get hold of one end. How would you do it? For solution, see page 112.

Editor's Note: This is the seventeenth in a series which started in the February 1952 issue of Civil Engineering. In the April 1952 issue an article, "The Unexpected in Engineering: The Bugs," explains the project and enlarges upon the central theme that problems of the past created the practice of the present; that "The engineering of today rests upon a coral reef; sturdy remnants of yesterday's bugs." The process is a continuing one; there will always be today's and tomorrow's bugs to add zest and gray hairs to the practice of a profession that by its very nature must cantilever from a codified past to an untried future. "Long live bugs" is an ever-present challenge to the virility and ingenuity of the engineer. If you have a good bug, why not share it? H.J.G.

The above problem was submitted by the Bethlehem Pacific Coast Steel Corp., for which M. H. Fruncke, A. M. ASCE, is the manager of erection.

Pittsburgh's Point development includes 36-acre Point State Park, bordered by 23-acre dog-leg strip being developed by the Equitable Life Assurance Society of the United States as site for office buildings. Ground was broken for first three of these on October 11, 1950, and third building was ready for occupancy in fall of 1952. Overall plan for Point proposes two new bridges and large traffic interchange (see article by George S. Richardson, M. ASCE, *Civil Engineering*, June 1953).

To protect against highest recorded flood levels, ramp entrance to garage, in building No. 1 (at left) can be closed with steel flood gates bolted to wall against rubber gaskets. Between buildings, floor of garage was thickened to 4 ft to prevent flotation. Behind garage entrance, work on DuMont television studio has been started.

Buildings in Pittsburgh's Gateway Center include

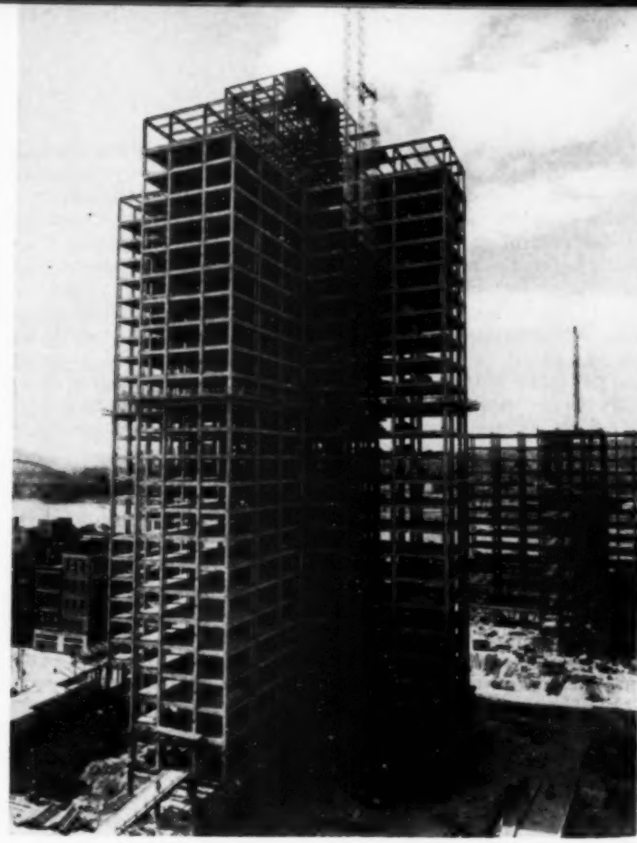
Special engineering problems met with in constructing the first three office buildings in the Gateway Center Project include fast scheduling to avoid impending material priorities, exclusion of flood waters from deep basement areas and protection of these areas against atomic radiation, provision of a water supply for air conditioning, development of a new type of exterior precast wall panel, provisions for tenant changes during construction, and safeguarding foundations of an existing building which had to be temporarily retained on the site. This project of the Equitable Life Assurance Society of the United States is located on a bent strip bordering Pittsburgh's new Point State Park at the tip of the Golden Triangle, where the Allegheny and Monongahela rivers meet.

The first section of the project consists of one 24-story and two 20-story air-conditioned office buildings of structural-steel-frame construction. These structures are cross shaped in plan and surmounted by penthouses 53 ft high to house tanks, air-conditioning equipment, and elevator machinery (Figs. 1 and 2). Above the main roof of the 24-story building is a penthouse apartment covering two wings. Three lower stories in the north wing of one of the 20-story buildings contain the new television studio for DuMont. Both of these additions, made after the steel frame had been erected, required extensive alterations.

At grade level between the buildings, the entire site is landscaped and traversed with walkways. Below grade, both under and between the buildings, there is a basement providing about 225,000 sq ft for the parking of 248 cars and for a restaurant, tenant storage, and mechanical equipment. A two-level reinforced concrete box conduit, providing circulating water for air conditioning, connects the refrigerating plant in the basement of building No. 3 with the Allegheny River. It passes under the basement floor, streets, large retaining and quay wall foundations, to intake and discharge chambers at the river bank.

Structural Steel Frame

At the time the design was started (May 1950) it was anticipated that more stringent material priorities were imminent and therefore structural steel design had to be given primary consideration so that orders for steel could be placed. The buildings were framed from outline architectural plans before it was definitely known what tenants would occupy them or what the particular requirements of tenants would be. The type of exterior wall to be used had not yet been determined at this stage of the



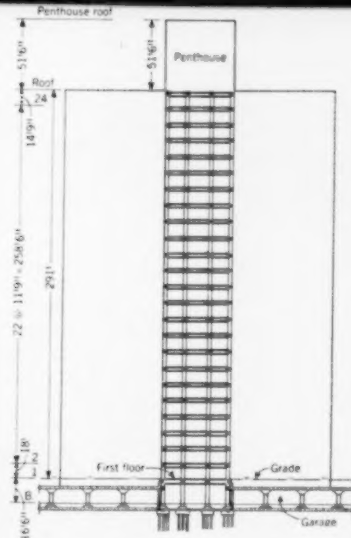


FIG. 1. Section through office-building wing also shows floor, columns, and roof-slab arrangement for underground garage. Between and under buildings, 4 acres of continuous basement are available for garage and other occupany. Roof of 20-in. concrete slab supports landscaped earth fill.

Left, lightweight gritcrete with mesh reinforcement is used for floors and for fireproofing columns, girders, and beams.

unusual structural features

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project, and provisions for air conditioning and other mechanical installations were in process of development. The unknown factors were estimated as closely as possible, and the design proceeded with the understanding that some modifications would be required as the work progressed. Plans were completed one month later, and the contract for fabrication and erection was let immediately, before foundation plans were started.

Steel framing, which followed the requirements of the Pittsburgh building code, consisted of 10WF or 12WF beams spaced about 8 ft apart and forming three spans (of 14 ft $3^1/_2$ in., 18 ft 2 in., 14 ft $3^1/_2$ in.) across the 49-ft 6-in. outside width of the wings. These beams connected with four lines of 18WF girders in three 24-ft spans, running longitudinally in the wing. At the column lines, transverse wind girders were provided in the outer spans only, leaving the

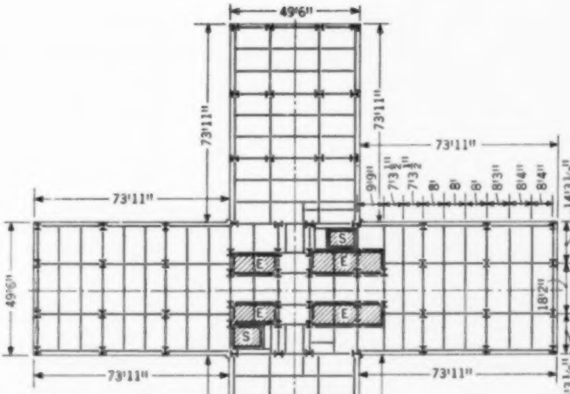

FIG. 2. Plan shows general design of steel frame for three office buildings already erected on strip bordering Point State Park. Framing consists of 18WF girders and 10WF and 12WF beams riveted to 14WF columns. Fabrication and erection of 13,000 tons of steel for three buildings was done by American Bridge Co.

Three office buildings are supported on H-piles driven about 50 ft to rock (above). At each building site, test pile (below) loaded to twice design load by jacking against ten adjacent piles, showed less settlement than allowable (0.001 ft in 60 hours).

center bay clear at the ceiling for air-conditioning ducts. Steel columns throughout were 14-in. wide-flange sections of various weights, and a few columns in the central core required cover plates below the second floor. All connections to columns were riveted, and minor beam-to-girder connections were bolted.

Wind analysis was based on limiting the deflection per story to $0.002h$. Wind girder sizes were "tuned" to the calculated deflections and were increased where necessary to maintain the required rigidity. Some additional strength was provided in the transverse bents of the wings because of the narrow width. For economy of steel, wind reactions were balanced at grade level, and transmitted through a specially designed joint to the substructure.

Except where unavoidable at spandrel beams and around openings in the floor, a special effort was made to frame all beams and girders on the center line of columns. This greatly simplified the detailing of beam-to-column connections. Wind connections generally consist of top and bottom angles or split-beam tees shop riveted to the columns with $^1/_4$-in. maximum filler plates on the top flange for ease of erection and to insure a tight fit. Web connections are also provided to carry the vertical shear.

While steelwork was being erected, long-term leases with prospective tenants were consummated, and their office layouts were submitted and approved. Because of increased floor loads in certain areas, such as telephone equipment rooms, vaults, library stacks, and heavy files, some steelwork had to be reinforced. This was generally accomplished by using composite beams, or by welding cover plates to the top and bottom flanges of the beams. No modification of the columns was required.

One alteration of major importance was the addition of a penthouse apartment on top of the 24-story building. To save weight, the new roof construction was made of 2-in. precast concrete plank and the walls of precast lightweight concrete panels with large window areas.

Another extensive addition was the new DuMont television studio on the north side of building No. 1. The area affected included the entire north wing in the basement and in the first and second stories, plus extensions filling in the corners of the cross on the east and west sides of the wing up to the third-floor level. The extensions were supported on new columns adjacent to, and braced to, each of the existing wall columns. The west extension contains a large open studio, spanned by steel roof trusses 72 ft long, supporting steel purlins and a precast plank roof from which are hung scenery, air-conditioning units, and miscellaneous equipment.

Steelwork for the three buildings and extensions amounted to about 13,000 tons. It was fabricated and erected by the American Bridge Co.

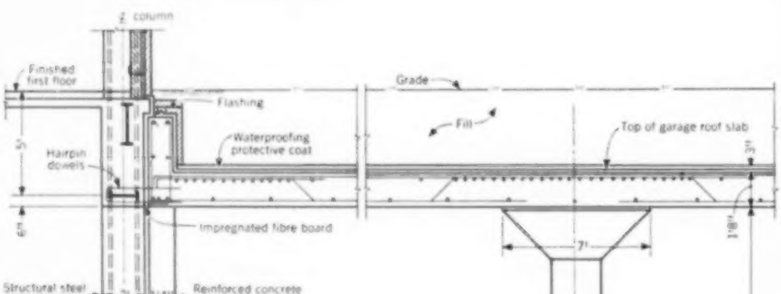

FIG. 3. Where garage roof slab meets building wall, carefully designed joint is used to secure watertightness and rigidity.

Fireproofed with Concrete

Except for the first floor and isolated areas of heavier-than-normal loading, where stone concrete of 2,500-psi ultimate strength was used, all floor arches are of mesh-reinforced gritcrete, a lightweight concrete product of the Aerocrete Co., weighing about 108 lb per cu ft. Typical slabs have a thickness of $4^1/_2$ in., increased where required by special loading or end conditions. A minimum of 0.081 sq in. per ft of mesh reinforcement was placed across the flanges of all girders which are parallel to the main direction of the floor mesh. Clips of 12-gage wire anchor the fireproofing concrete to the flanges of all beams and columns. In addition, beams over 21 in. deep have haunch-stiffening wires in the vertical sides. Fireproofing was installed by the Knickerbocker Construction Corp.–Brennan & Sloan.

Buildings Rest on Steel H-Piles

The building foundations were designed and built in the period between the award of the structural steel contract and the delivery of the first steel to the site. From borings, test pits, and general excavation, which had meanwhile been proceeding, and after studies and cost analyses of various types of foundations, it was finally determined that steel H-piles driven to rock were the most suitable for the site.

The three office buildings rest on a total of 1,379 such piles (14-in. 89-lb), all driven through the overburden an average of 50 ft to rock. To determine the number of piles for the wall columns it was necessary to estimate the probable loads from the basement structure between the buildings, plans for which had not yet been finally developed.

Reinforced concrete pile caps were used to distribute the column loads to the piles. All piles were measured after being driven, and pile caps were redesigned on the job whenever the survey revealed any misplaced piles. Piles were furnished and driven by the Western Foundation Corp. under the continuous supervision of the builders and engineers. To provide against possible maximum floods from the Monongahela and Allegheny rivers, all basement floors were designed as pressure slabs to withstand up to 37 ft of water pressure. Original plans called for this slab to pass over the pile caps and under the column base plates. However, the structural steel arrived first, and the pile-cap designs were modified to permit setting of the columns by extending the caps upward with keys and dowels for the slab. A number of caps in each building were deepened considerably because of large adjacent pits. Because of the possibility of floods and the development of wind pressure on the superstructure, reinforced concrete tie-beams were used to connect the tops of the wall-column pile caps.

Foundation construction was complicated by the presence of a building on the site, the lease for which did not expire for another six months. This was a seven-story reinforced concrete trade school, the foundations of which were above those required for the new buildings. The deepest section of the new project—the subbasement for the air-conditioning equipment, which was about 30 ft below grade—occurred at this location. Excavation was made practically adjacent to the existing building without underpinning. The H-piles close to this structure were driven from grade with a follower before the general excavation was completed.

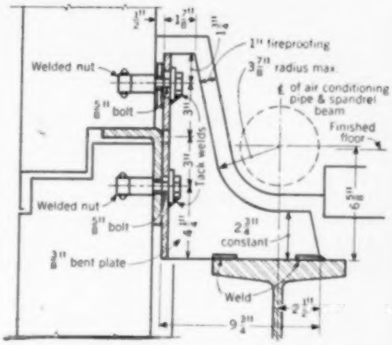

FIG. 4. Typical steel-faced wall panel is fastened in place with welded brackets and bolts.

FIG. 5. Building walls consist of standardized precast perlite-concrete panels $4\frac{1}{2}$ in. thick, faced with chrome stainless steel. Details of four main types of panels are shown in cross section (which corresponds with building in photo above, proceeding to left from corner). Every floor required 252 panels weighing from 1,000 to 6,000 lb each, and attached to steel frame with bolts and brackets.

A temporary earth berm, left surrounding the building, was retained by sheeting spanning between a series of H-piles whose tops were tied to the basement columns of the old building by cables with turnbuckles. Excavation for the new pile caps was made in the earth berm in pits protected by horizontal sheeting installed progressively from the top down. Spencer, White & Prentis, Inc., the contractor for this work, cooperated with the engineers and builders in developing the technique of maintaining the stability of this existing building.

Cooling Water Brought from Allegheny River

Cooling water for the air-conditioning system was one of the important features in the planning of the Gateway Center development. The best source of water was the Allegheny River, but because of the relatively high temperature of this water in summer (85 deg F), the engineers estimated that 35,000 gpm would be required. It is to be screened at the intake, then filtered and chlorinated at the refrigerator plant in the basement of building No. 3.

The original plans called for two concrete pipes of 48-in. diameter, 24 to 34 ft apart, but at the contractor's suggestion, the design was changed to two reinforced concrete box conduits, one above the other, 42 in. wide by 48 in. high. The intake conduit was placed below the discharge and its invert sloped from El. 702.5 to 699.5, as compared to El. 715.5 for the garage floor under which it passes, and El. 710 for the normal Allegheny River pool.

The river, at its nearest point, is at a distance of 590 ft northerly from the refrigerator plant. To reach it underground required passing for 353 ft under the garage floor; for 38 ft under Duquesne Way; for 94 ft through land partially occupied by the foundations of the Pennsylvania Railroad viaduct; for 28 ft beneath a two-lane underpass; for 54 ft beneath an existing roadway ramp at the river; and for 23 ft beneath a wharf floor to the river discharge chamber. The conduit then runs parallel to the river for 76 ft to the

new intake chamber, and finally passes through the river wall in three places.

Open excavation for the conduit was supported by driving vertical pilot beams to an elevation below subgrade, bracing them across the cut, and installing horizontal louver boards as the excavation progressed. The alignment was selected to miss the foundations of the Pennsylvania Railroad viaduct. Because Duquesne Way had to be kept open for traffic, and because there were gas and water lines running below the pavement, the conduit here was installed by hydraulic jacking. A section long enough to reach completely across the street was built in the adjoining cut and jacked through beneath the street. Men excavated inside as jacking progressed. Excavation beneath the underpass was done by opening half of the street at a time and immediately decking it over. Excavation was carried on under the deck, in which openings were left for removal of the excavated material.

Because the top of the conduit was 26 ft below the roadway ramp previously mentioned, the conduit was built there by tunneling methods. Both walls of the ramp were supported on concrete piles, many of which interfered with the conduit and had to be cut off; they were replaced with Pretest sectional hydraulic cylinders installed under the wall each side of the tunnel.

The space between the ramp wall and the river was about 6 ft above the normal pool level and was used as a wharf. The intake and discharge chambers were located in this area, the former about 76 ft upstream from the latter. The river wall had been built by the U. S. Engineers and extended down to El. 697 with a line of steel sheetpiling below to provide a cutoff. This cutoff was found to be effective and excavation was carried to as much as 16 ft below the pool level without difficulty.

The three openings through the river wall, two in the intake chamber and one in the discharge, were cut out after both structures had been concreted. At each side of each opening frames were set by divers and anchored to the wall. With the permanent stoplogs set in place, the necessary portions of the wall were removed from the land side. No appreciable leakage occurred.

The entire operation was a complete success and saved about 35 percent of the estimated cost of a pipe design. No ground was lost, no damage occurred to adjoining structures, and interferences to traffic from construction work on the site were negligible. Spencer, White & Prentis, Inc., were the contractors for the cooling-water conduits.

Underground Garage Provided

Between the steel office buildings, an area of about 168,000 sq ft of basement is roofed over with a 20-in. reinforced concrete flat slab designed to exclude atomic radiation (Fig. 1). Typical bays are 28 ft 6 in. by 26 ft 6 in., with round columns of 28-in. diameter. In the garage area, the columns are provided with round capitals of 7-ft diameter and in the tenant and restaurant area, the columns have drop panels 10 ft 10 in. by 9 ft 4 in. by 10 in. thick, but no capitals. A minimum clear height of 11 ft 0 in. is provided from basement floor to ceiling.

In addition ~~to live~~ load and its own dead weight, this roof supports 3 in. of waterproofing and protective coat, and an average of 42 in. of earth fill, a total load of 726 psi. The earth fill is drained by 8-, 10-, and 12-in. pipes buried in it, which also pick up surface runoff at catch basins throughout the area, and empty to sewers in the surrounding streets.

A maze of ventilation tunnels traverse the fill, radiating from plenum chambers at the buildings to intake and exhaust structures which rise above the fill at points remote from the buildings to suit the landscaping. These structures are of reinforced concrete faced with granite above grade. Tunnels generally are 7 ft 0 in. wide by 2 ft 3 in. high, with a roof of precast slabs 6 in. thick (except at angles, where poured slabs were used) supported on walls of 6- or 8-in. poured concrete.

Special attention was given to the joint separating the reinforced concrete deck slab over the garage area between the buildings and the structural steel frame of the buildings (Fig. 3). This joint had to be watertight and no relative motion between the two could be permitted. For economy in structural steel, wind reactions from the buildings were balanced by the lateral support of the deck, making it necessary to transmit wind forces of either tension or compression through the joint. At the same time, anticipated movement due to unavoidable shrinkage in the slab was provided for by means of a blind joint. The flat-slab deck terminates in an upturned spandrel beam kept 1 in. clear of the concrete fireproofing of the steel building. These spandrel beams are supported on reinforced concrete columns, which are placed opposite to each of the steel building columns and rest on the same foundations. These twin columns are 1 in. apart for the full basement height. In the framing of the buildings, a fireproofed 16WF beam, laid flat, connects the wall columns at the level of the outside slab to transmit the wind load. These beams are attached to the slab by U-shaped dowels which are wrapped around the beams and extended across the 1-in. gap for anchorage into the deck slab. The space between beams is filled with impregnated fiberboard which is capable of transmitting compression and at the same time able to expand or contract with shrinkage or other movements of the concrete. The upturned spandrel beam is flashed to the building wall above to complete the joint.

In a few deep basement areas, as under the pump pit for the air-conditioning units, where foundations reach El. 693, the pressure slab for the required dead weight was made 7 ft thick. In other sections not quite so deep, plans called for the pressure slab to be built as box sections filled with heavy gravel, but the cost of form work made it cheaper to make them solid concrete. In the areas between the steel buildings, the pressure slab generally is 26 in. thick, topped by 20 in. of concrete fill and finish. This slab, poured on undisturbed ground, was designed as an inverted flat-slab mat foundation to support the roof-deck columns. Together with the roof superstructure and the earth fill to grade, it provided the necessary weight to resist the hydrostatic uplift pressure.

Under the steel office buildings, to provide for uplift pressure, similar reinforced concrete pressure slabs, 16 to 20 in. thick, were framed between the pile caps. On top of these slabs, 14 in. of concrete fill and finish were provided as space for piping.

The car ramp leading down into the parking space from the street level is designed with cantilevered concrete side walls to act as a concrete "tub" and provide protection from all floods below El. 719.0. For higher water, the entrances at the bottom of the ramps, through the wall of the building, are provided with structural steel flood gates, which operate on overhead tracks, and when not in use are withdrawn into a recess provided along the exterior wall. These are furnished with a rubber gasket around all four sides similar to the watertight doors for ships, and when closed, are bolted to the outside of the walls. All bolts and tools are racked on the gates, where they will be available for

(Continued on page 114)

Vortex motion in viscous fluids studied in apparatus consisting of concentric glass cylinders

This description of equipment for a fluid mechanics laboratory is the third in a series sponsored by the Fluid Dynamics Committee of the Engineering Mechanics Division.

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HUON LI, Graduate student in civil engineering, University of California, Berkeley

The occurrence of vortexes at the drains of sinks and bathtubs, near the suction lines of pumps, near the banks of deep rivers, as small dust devils in a gusty wind or as terrifying hurricanes, has always intrigued the layman and somewhat puzzled the engineer. The engineer was mostly puzzled by the uncanny persistence of this whirling motion, which defies almost all attempts at suppression.

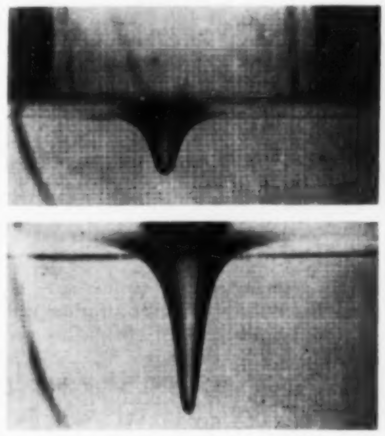
The rather elementary theory of the single vortex in a frictionless (ideal) fluid shows that the preservation of the moment of momentum explains this persistence. The earth's rotation is often sufficient to create violet vortexes, especially near drains of other narrow sections through which a fluid flows. Since this elementary theory gives no indication how the development of such vortexes can be prevented, or how they can be slowed down once they have developed, a more complete theory was needed to solve the practical problems—a theory that includes the internal friction of the fluid.

Such a theory was given by Huon Li in his thesis, "Single Vortex in a Real Fluid," University of California, Berkeley, 1951. The results of this theory were tested in the instrument shown in the accompanying photograph and in Fig. 1, and were found to describe the actual flow very accurately. As this instrument affords an excellent demonstration of all flow aspects in a single vortex, it is today often used for demonstrations at Berkeley and might well be used for the same purpose elsewhere.

In this instrument two glass or plastic cylinders are held concentric by a system of baffles between them. The outside cylinder has a bottom with a central drain hole, while the inside cylinder is unsupported at its lower edge and may be lifted to any elevation above the bottom of the larger cylinder. A drain pipe with throttling valve is added to the drain hole to permit regulation of the discharge without any interference with the flow inside the cylinder. This entire apparatus is mounted on a tripod such that it may be rotated around the common cylinder axis. If the water, which continuously drains from the center hole, is replaced by an equal discharge entering continuously into the slot between the two cylinders, the water, because of the baffles, has a prescribed moment of momentum at the cylinder. If the fluid were frictionless, it would maintain that moment of momentum during its travel to the drain hole. The actual flow is somewhat damped by viscosity. The velocity distribution and the water-surface profile differ somewhat from those of the ideal vortex.

Li showed that an exact theory can be derived for the viscous vortex on a two-dimensional basis, that is, assuming that all horizontal slices of flow are alike. This theory shows that the flow distribution between the cylinder and the drain depends not only on the initial flow condition and the internal friction in the fluid, but also on the exit condition at the center. It shows, furthermore, that the centrifugal effects in the entire fluid body tend to keep the flow two-dimensional, which explains why this simplified solution actually describes the real flow.

This equalizing tendency suggests a method of combating vortexes of this kind. If the circulation in one slice can be slowed down, the rest of the flow will follow and be slowed down too. This fact can very easily be demonstrated by roughening the bottom of the cylinder. This can be done by placing some pebbles there or any other rough material. With this roughness in place the eddy becomes much less violent. This behavior points to one way of eliminating vortexes near pump intakes.



Characteristic water-surface profiles for single vortex, photographed in instrument shown in photo below and in Fig. 1, show that depth of vortex is less for low discharge and low rotational speed (top) than for high discharge and high rotational speed (above)

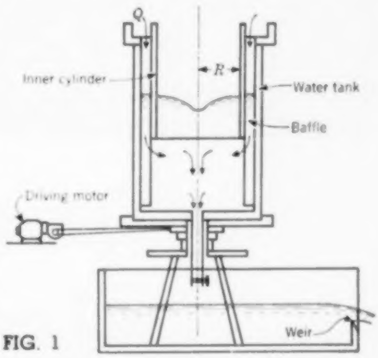
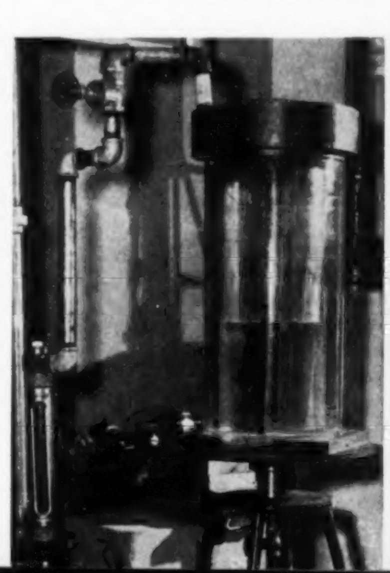


FIG. 1



Pile driving begins on foundations for largest lift-slab structure to date. Built to serve as barracks for Navy personnel, structure will stand on 550 cast-in-place piles. Cost per man of $1,687,000 structure is $1,125.

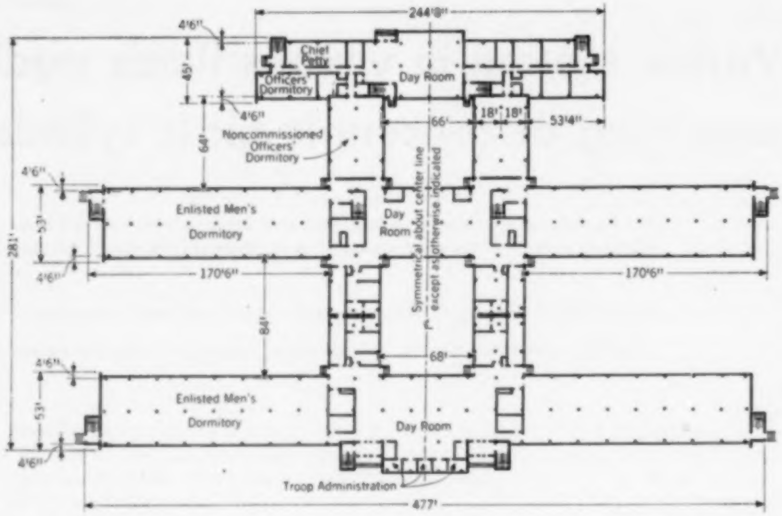
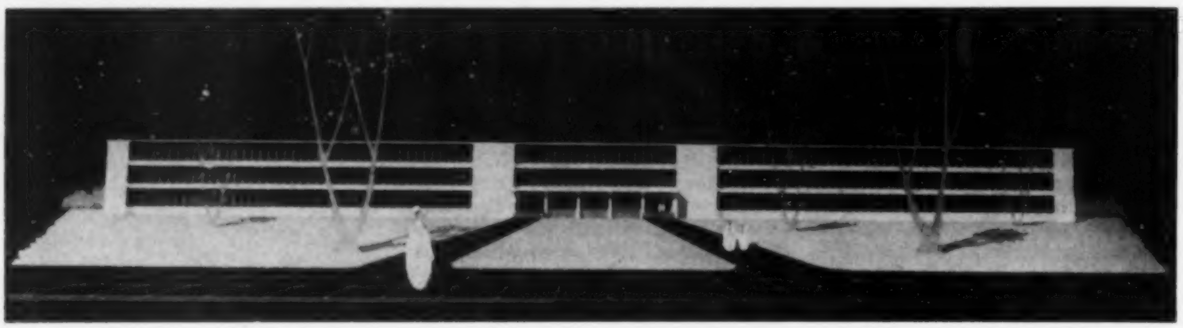


FIG. 1. Simplicity of structural layout and large floor area recommended lift-slab method of construction for U. S. Navy barracks at Norfolk, Va.



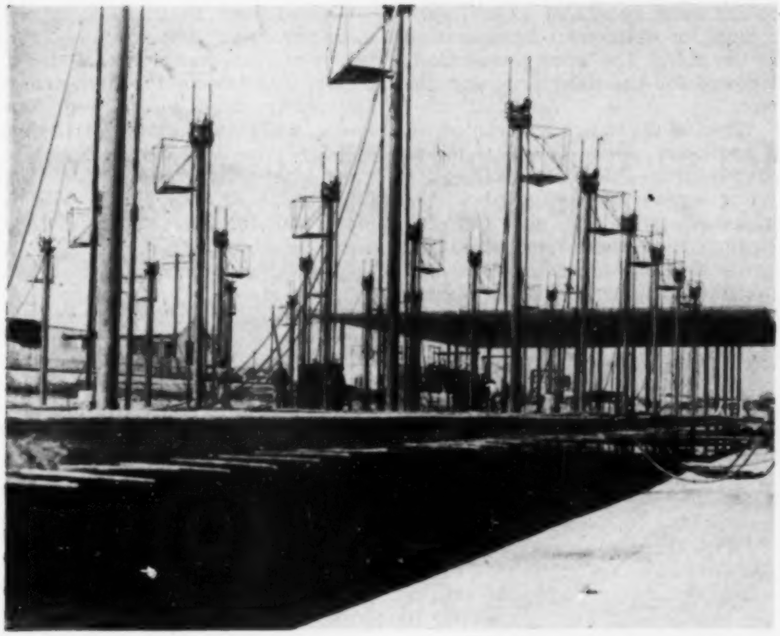
Navy barracks for 1,500 men under construction at Norfolk, Va.

Largest structure to date built

A 1,500-man barracks, which can accommodate another 600 men in an emergency, is being constructed by the lift-slab method at the U. S. Naval Amphibious Base at Norfolk, Va. This three-story building is the largest structure yet to be erected by the lift-slab method. Probably also the largest Navy-owned barracks, it is one of eight contemplated in the ultimate development of the base.

Standard Navy plans call for two-story barracks housing 228 men each. Provision of such quarters for the anticipated number of trainees at the amphibious base would have required the utilization of so much of the limited land available as to seriously hamper training activities. The three-story structure here described, arranged to take care of a complete organizational unit, occupies a minimum of ground area per man in compliance with safe operational requirements. The building is shaped like two E's back to back (Fig. 1). The overall frontage is 477 ft; the overall depth, 302 ft 8 in.; and each wing is 47 ft 4 in. wide. The building contains 12 large dormitories (divided by hardboard walls 6 ft 6 in. high into cubicles for groups of 20 men each) and 38 rooms quartering two to four chief petty officers each. Also included are toilets, scrub rooms, offices, bag rooms, etc., and two large day rooms on each of the first and second floors.

The simplicity of the structural layout, the extensive floor areas, and the three-story design recommended consideration of the lift-slab method of construction. To familiarize local contractors with this method of construction, before bids were received the architect-engineers arranged for a motion picture depicting this type of



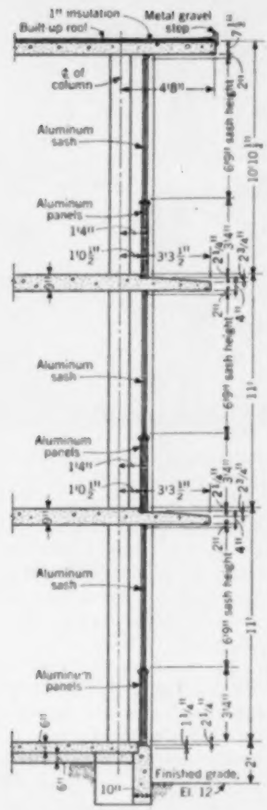


FIG. 2. Slabs cantilever over sides of building, but not over ends. Ends of structure are reinforced concrete while sides have aluminum spandrels and sash. Floors will be covered with asphalt tile.

Console at right can control 12 jacks on 12 columns at one time. Valves control rate of rise at each jack, and indicators beneath each valve show operator amount of rise. Contractor on Norfolk Navy barracks plans to use two 14-jack panels, thus lifting, on 28 columns at one time, a slab 53 by 150 ft. Use of console on another lift-slab job is shown in photo above.

←

U. S. Navy barracks at Norfolk, Va., will house 1,500 men, with space for 600 additional in an emergency.

by lift-slab method

EDWARD K. BRYANT, M. ASCE

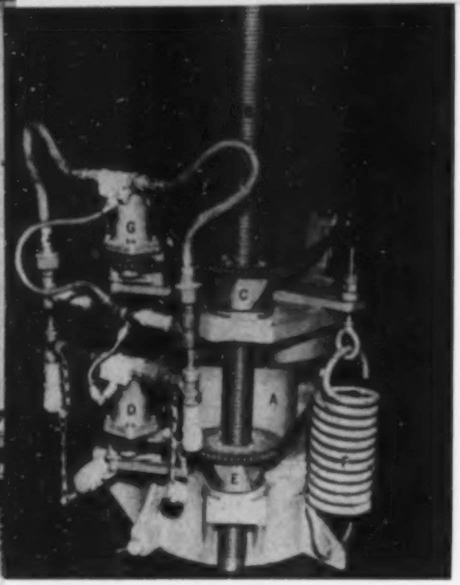
Knappen-Tippetts-Abbett-McCarthy, Engineers

work to be shown by a representative of the Institute of Inventive Research, sponsors and developers of the Youtz-Slick system.

When bids were received by the Public Works Officer on June 17, 1953, a low bid of $1,687,000, or about $1,125 per man, was submitted by the Lang Construction Co., Portsmouth, Va. This compares very favorably with the standard Navy allowance for barracks construction of $1,350 per man. Separate bids for each method were not obtained. The method of construction to be used was optional with the contractor.

The building is founded on 550 cast-in-place piles supporting footings. Square columns are formed of $8 \times 8 \times \frac{1}{2}$-in. angles. Longitudinally the columns are generally spaced 20 ft on centers, while transversely they are 22 ft on centers. There are cantilever overhangs on the sides of the building but not on the ends. The ground floor slab is 6 in. thick, the second and third floor slab 9 in. thick, and the roof slab $7\frac{1}{2}$ in. thick (Fig. 2).

The floors are given a magnesium fluosilicate treatment and covered with asphalt tile, except in toilets and scrub rooms, where ceramic tile is used. The ceilings are unfinished, except in the day rooms, which have acoustical tile. The exterior consists of solid reinforced concrete end walls while the side walls have cellular aluminum spandrels 3 ft 6 in. high and continuous aluminum sash 6 ft 9 in. high. The floor-to-floor distance for the first and second stories is 11 ft and for the third story 10 ft $10\frac{1}{2}$ in. Floors, roof, and end walls are designed of 3,000-lb concrete. Floor reinforcing steel consists of straight bars distributed on the principles of flat-slab design. Bar sizes range from



Hydraulic jack for lifting slab is seated on top of structure column. To lift slab, piston (A) is pumped upward, pushing threaded rods (B) straight up (no turning), gripping them by nuts (C). Lower ends of long rods are threaded into collar cast into slab, drawing it up column. Meanwhile small hydraulic motor (D) turns second lower pair of nuts at (E) seated on base of jack, to take up rise. At end of piston stroke, pressure is released, and spring (F) pulls piston head down again—rods are now being held in their new high position by nuts (E). As piston head descends, upper pair of nuts (C) is turned by small hydraulic motor (G) to follow piston head down and to take fresh "grip" on rods for another push. All jacks are synchronized by an operator who rides up on slab with control panel (console). Lugs are welded to columns under slab collars to hold them permanently.

$^1/_2$ to $^3/_4$ in. The end walls of each wing and the long transverse walls at the interior end of each dormitory area are designed as shear walls in accordance with Navy requirements for provision against blast effect.

After the ground has been graded, the columns erected on the footings, steel reinforcing, piping, ducts and sleeves placed, and side forms built, a section of the first floor is poured. After at least 18 hours, when this slab has taken a firm set, a separating medium having a paraffin or wax base is brushed or mopped over the entire surface. Side forms, reinforcing, piping, ducts, etc., for the second floor are then placed on top of the first slab. Slots in the floor, through which the interior concrete walls are poured, are also formed at this time. The second floor is then poured, using the first floor as a bottom form. Specially designed cast-steel lifting collars must be placed around each column for subsequent incorporation in the slab. The same procedure is followed for the third floor and the roof.

When all the slabs have been cured, a hydraulic jack is placed on top of each column. Vertical, full-threaded lifting screws are connected to the hydraulic jacks and into threaded bushings set in the column collars cast in the top slab. Each jack is connected by rubber hose to an operating cabinet called a console because of its resemblance to an organ. Hydraulic pressure is supplied to the console from a portable power unit placed at ground level. A timing gear mounted on each jack registers the number of revolutions of a gear riding on the lifting screws and indicates the relative rise of the slab. Each gear is connected to the console so that the operator can read the amount of rise on all columns simultaneously. He controls the rate of rise by valves on the hose running to the jacks so that the jacks raise the slab uniformly throughout its area.

At the beginning of the lifting operation the top slab is broken loose from the one directly below and raised about $^1/_4$ in. Measurements are made on each column and the slab is adjusted at each point to assure that it has reached the same elevation all around. The counters are then set to have the same reading and the lifting operation is resumed. The rate of lift is approximately 5 ft per hour. At intervals of about 15 minutes a measurement check is made on each column to assure that the slab is rising uniformly. After the slab has reached its design elevation, 1-in. steel blocks approximately 4 × 4 in. are welded to the steel columns immediately below the collars to support the slab after removal of the jack shafts.

The size of the slab that can be lifted is limited by the control panel, which normally handles only 12 jacks but can be expanded to 14. The contractor at the Norfolk Amphibious Base plans to use two 14-jack control panels, thus lifting simultaneously on 28 columns, to raise the 8,000-sq ft slab.

Elimination of the bottom form of the slabs is the greatest saving in using the lift-slab method. In the Norfolk area the saving is even greater than it would be elsewhere since the large volume of building going on there would be almost certain to necessitate premium pay to obtain the estimated 400 carpenters required for forming this barracks structure.

Ground-level construction eliminates the cost of hoisting form lumber, reinforcing rods, concrete, ducts, piping, and labor. Further savings may be realized by placing door bucks, windows, portable partitions, and other building materials on the slabs immediately before they are raised so that these items will be lifted with the floors on which they are to be erected.

Completion is scheduled for June 1954.

Plans for the structure were prepared by Knappen-Tippets-Abbett-McCarthy, engineers, New York, in association with Woodward, Oliver and Smith, architects, Norfolk, under the direction of Capt. A. J. Fay, Jr., Public Works Officer, Fifth Naval District. The author is project engineer for the architect-engineers.

Tossing silver dollar below tip of first pile driven for new Navy barracks is Rear Adm. Rufus E. Rose, USN, Commander Amphibious Training Command, U.S. Atlantic Fleet. Civilian at left is L. H. Schlobahm, president of Lang Construction Co., which is erecting building. Others present were Rear Adm. H. W. Johnson, CEC, USN, 5th Naval District Civil Engineer; Rear Adm. J. M. Taylor, USN, Chief of Staff, Commander, Amphibious Forces, Atlantic Fleet; Brig. Gen. L. B. Cresswell, USMC, Commanding General, Troop Training Unit, Atlantic Fleet; Capt. C. C. Hoffner, USN, Commanding Officer, Naval Amphibious Base, Little Creek, master of ceremonies; and Capt. A. J. Fay, CEC, USN, 5th Naval District Public Works Officer. Civilian at right is Edward K. Bryant, Project Engineer for Knappen-Tippetts-Abbett-McCarthy, designers of structure, and author of this article.

Jet-piercing method applied to quarrying aggregate

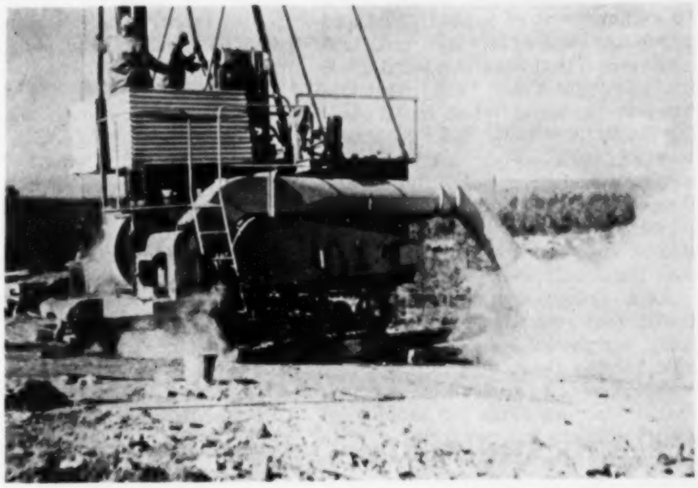
Taking a cue from the mining industry, operators of the Consolidated Quarries Corporation, of Lithonia, Ga., are applying jet-piercing to the production of crushed stone. The method, developed by Linde Air Products Company, involves the use of thermal energy to produce holes in rock. The heat is provided by burning a hydrocarbon fuel such as kerosene or a low-viscosity fuel diesel oil and high-purity oxygen. The temperature of the flame is in excess of 4,000 deg F, and its gas velocity is about 6,000 ft per sec. At the burner head, the flame is surrounded by a circle of holes out of which the cooling water is forced under pressure.

The action of the flame is to cause a thin layer of rock to expand and break away from the base material. New rock is thus exposed and the process is repeated. The dynamic force of the jet and the steam from the cooling water force the spalled particles out of the hole.

The equipment for jet-piercing is simple and can be easily mounted on a churn-drill rig. The components are a long blowpipe, a burner head, some device for measuring the depth of the hole, necessary hoses for the three process fluids, and valves and gages for controlling the flow of fuel, oxygen and water to the burner head. Some ducting is also desirable to direct the exhausted dust and steam away from the operator.

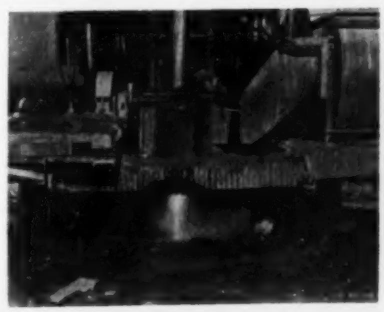
The completed holes are $6^1/_2$ in. in diameter. Drilling rates of 42 ft per hour in granite have been recorded at the Consolidated Quarry but the average rate is about 30 ft per hour. A total depth of as much as 195 ft of hole per 8-hour day has been achieved. The greatest depth that has been reached to date in a single 6.5-in. hole in this quarry is 116 ft, but another quarry using jet-piercing reports depths of 140 ft. Results of jet-piercing at the Consolidated Quarries are shown in the box.

Not all rocks are suitable for jet-piercing. Rocks such as quartzite, sandstone, granite, and dolomite are excellent because they spall readily. Diabase traprock and some low-silica and coarse-grained granites have a tendency to melt. They can be pierced with a jet flame, but at slow rates.



Above:

Jet-piercing equipment is mounted on standard drill rig for Consolidated Quarries Corp., in Lithonia, Ga. Exhaust-fan installation removes steam and rock particles from operating area.

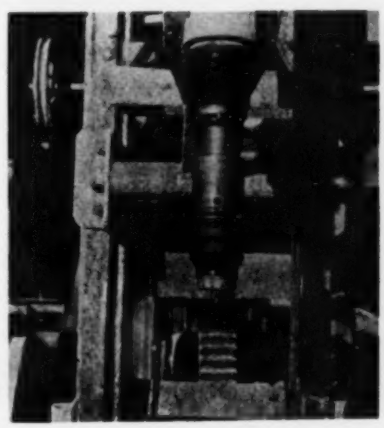


Right:

Burner head, with blowpipe flame ignited, is gradually lowered as operation proceeds.

Jet-piercing results at Consolidated Quarries

Type of rock	fine-grained biotite granite gneiss
Hole diameter	6.5 in.
Average hole depth	77 ft
Average hole spacing	34 ft apart 18 ft back from quarry face
Average piercing speed	30 ft per hour
Average breakage	50 tons per ft of hole
Oxygen	378 cu ft per ft of hole
Fuel used	kerosene
Fuel consumed	10.0 gal per ft of hole



Burner at flame end of blowpipe is surrounded by holes from which issues cooling water spray.

Vermiculite concrete insulates cantilevered heating slab

The new 5-million-dollar warehouse of the Pitt-Penn Terminal Co. in downtown Pittsburgh, Pa., contains 10 million cu ft of heated office and warehouse space so laid out and mechanized that four men handle 600 tons of freight a day. Two other features are unusual. The truck loading dock, over 1,600 ft long, is sawtoothed at a 30-deg angle to the street. And the radiantly heated floor of the mezzanine offices is exposed on its under side to the elements, the offices being cantilevered over the dock.

This design satisfies the city's traffic requirements, provides maximum warehouse space on the valuable ground floor, and puts loading operations completely under cover. But it posed an insulation problem to assure uniform and comfortable office temperatures in winter without excessive fuel consumption. Besides the basic requirement of low thermal conductivity, the insulating material had to be weather resistant and to have a certain amount of strength, for the span between the steel beams is 7 ft. Economical installation was also desirable.

After a series of tests, a 1:4 mix of vermiculite concrete (1 part portland cement to 4 parts vermiculite concrete aggregate) was chosen for the exposed insulating base. It was reinforced with 4 × 4 × 6-gage wire mesh and placed 4 in. thick over steel forms to secure a smooth undersurface. A film of cement grout, $^1/_{16}$ in. thick, provided a hard, impervious finish that could be easily painted.

The $^3/_4$-in. pipe of the hot-water radiant heating system was spaced 9 in. on centers on top of the insulating slab. Over it went 5 in. of structural concrete, which carries the floor load. The insulating concrete was suspended from the structural slab on No. 9 tie wires spaced 18 in. on centers down the center of each beam spacing, and 18 in. on centers for the length of the building parallel to the structural supports and halfway between them.

Construction is steel and masonry throughout. Steel-plate cantilever girders, 25 ft on centers, run the length of the buildings. Perpendicular to the girders are 16-in. steel beams, 6 ft 8 in. on centers. Supporting steel columns are 25 ft on centers lengthwise, and 22 ft 8 in. on centers across the building. The columns are numbered and serve as a space layout for the piles of merchandise.

Bay size within the warehouse is approximately 23 by 25 ft. This was the most economical arrangement possible to take care of foundation problems, space requirements for easy merchandise storage, and the cost of steel framing. Merchandise is palletized wherever possible and stacked to a maximum height of 23 ft.

The mezzanine floor is 27 ft 8 in. wide and has a ceiling height of 9 ft 6 in. A total of 54 offices run the length of the buildings on the Penn Avenue side. The average office is 22 ft by 25 ft. The offices open on a corridor that also runs the full length. Corridor windows on the warehouse side, overlooking its interior, provide a convenient vantage point from which the customer leasing warehouse and office space can check his stock simply by stepping through his office doorway. The windows also enable the terminal management to see everything that goes on, thus facilitating control of operations. Offices are now being air-conditioned.

Mechanical services and toilet, locker, and lunchroom facilities are concentrated in towers roughly 250 ft apart. This is a convenient limit of travel for those using the facilities and takes up the very minimum of warehouse floor space. The building has automatic sprinkler protection throughout, a complete burglar alarm system, and 24-hour watchman service. All employees are bonded.

Engineers for the terminal were Hunting, Larsen & Dunnells of Pittsburgh, Pa. The contractor was the Trimble Co., Pittsburgh, Pa.

Vermiculite insulating concrete was placed over metal forms (left-hand photo). Next radiant heating pipes were laid and covered with structural concrete. Insulation was needed because heated slab is cantilevered out over truck loading platform. Exposed under side of cantilevered slab (right-hand photo) over truck dock was covered with $^1/_{16}$-in. layer of grout, which provided hard impervious finish that could be easily painted.

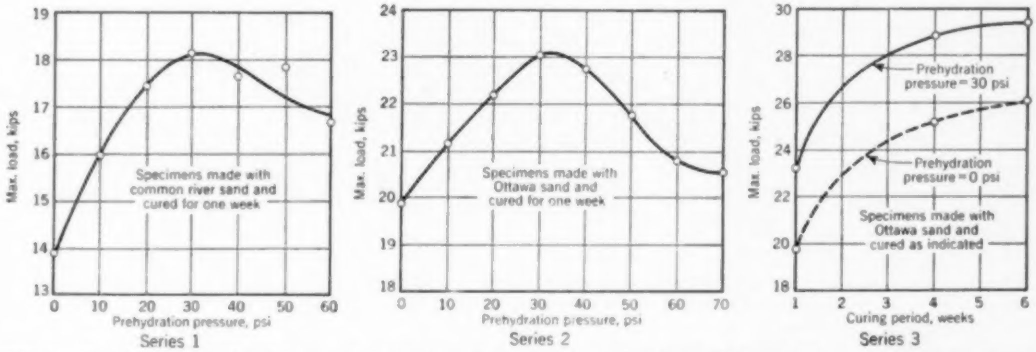


FIG. 1. Graphs show results of three series of tests on 2-in. cement mortar cubes. Each point is average of 9 specimens.

Pressure prehydration increases strength of hydraulic cement mortar specimens

THOMAS H. WHITFIELD, JR., A.M. ASCE, Assistant Engineer, Central of Georgia Railway Co., Savannah, Ga.

Strength of hydraulic cement products depends to a great extent on the degree of hydration of the cement. Curing assures that water will be present to cause hydration, and fine grinding of the cement assures that there will be a greater surface area on which water can act. Both factors are conducive to a more complete hydration, indicating that the more intimate the combination of water and cement, the greater the strength of the resulting product.

In connection with thesis work at the School of Mines and Metallurgy of the University of Missouri, the writer conceived the idea of obtaining a more intimate combination of water and cement by employing pressure to force water into the particles of cement. To test the validity of this idea he carried out three series of tests designed to throw light on the following questions:

1. Would the use of pressure to force water into the cement particles result in an increase in the strength of 2-in. mortar cubes?
2. What would be the optimum pressure for a 3-min period of pressurization?
3. Would the increased strength obtained by this means be maintained after a reasonable lapse of time?

The first series of tests was concerned with the first two questions. The second series was carried out to verify the results of the first series under conditions of more rigid control. The third series of tests was concerned with the third question.

Procedures Common to All Tests

Two-inch mortar cubes were used because a larger number of specimens could be made and tested during the time allotted and with the assistance available than if concrete cylinders were used. It should be pointed out, however, that these tests are considered only as preliminary to the application of the prehydration process to concrete.

The specimens were formed in stainless steel molds conforming to ASTM Designation C 109-47. A Tinius Olsen testing machine, set for a 100,000-lb load limit, was used, the traveling head being rigged with a ball-and-socket arrangement to prevent eccentricity.

No attempt was made to control temperature, but it was noted that the average temperature was about 75 deg F, and variations were not significant.

The molds were prepared by being completely disassembled and cleaned with a brass brush. Interior faces of each mold were covered with a thin film of light grease before reassembly. To prevent "bleeding" of the molds, the joints were filled from the outside with melted paraffin. All equipment that came in contact with the mortar or cement paste was wet with water to prevent loss of water from the mix.

The cement was placed in an enameled pan and the water added to it and thoroughly mixed in with a rubber spatula. The paste was then placed in the pressure tank, which was immediately sealed. Compressed air from the laboratory source was allowed to enter the tank until the desired pressure was obtained. This pressure was held constant for a period of 3 min, after which it was released, the tank opened, and the mixture removed.

Next the paste was placed in the mixer and agitated for 1/2 min. At that time half of the batch of sand was added. After another 1/2 min of mixing, the remainder of the sand was added, and the mixer operated for another 2 min. At the end of the mixing period the mixer was stopped and the bowl containing the batch of mortar removed.

To mold the specimens, each of the three units of the first mold was filled about half full of mortar. The mortar in each compartment was tamped with the plastic tamper 32 times in about 10 sec, in four rounds, each being at right angles to the other and consisting of eight adjoining strokes over the surface of the specimen. After the first layer in each compartment of the first mold had been tamped, the compartments were filled heaping full and the tamping process was repeated exactly as before.

On completion of tamping, the steel spatula was used to strike off the excess

mortar and to smooth the top of each specimen. This procedure was repeated until all the molds were filled.

The molds containing the specimens were placed in the moist closet for a 24-hour period. Next the specimens were taken from the molds, tied lightly together in bundles of three, tagged for identification, and submerged in the curing tank, where a depth of water of about 6 in. was maintained.

Variations Between Different Series

In the preceding paragraphs the procedures common to all three seires of tests have been outlined. Variations will now be noted.

The specimens for the first series of tests were made with 825 grams of cement, 350 cu centimeters of water, and 1,650 grams of common river sand. Those for the second and third series contained 1,000 grams of cement, 330 cu centimeters of water, and 2,000 grams of natural silica sand from Ottawa, Ill.

The sand used for the first series was clean, common river sand with a fineness modulus of 2.71 and a gradation comparing favorably with the Bureau of Reclamation's standard requirements. The cement was ordinary portland cement in excellent condition, and from a single sack.

The specimens for the second and third series of tests were prepared using natural silica sand from Ottawa, Ill., graded for laboratory use. The cement was of the same type as that used for the first series and came from a single sack.

The specimens in the first and second series of tests were kept in the curing tank for six days; those in the third series were left in the curing tank for varying periods, as shown in Fig. 1.

The specimens in the third series were subjected to prehydration pressures of either zero or 30 psi, as indicated by the two curves for this series in Fig. 1, rather than to the complete range of pressures used for specimens in the first and second series of tests.

Test Results Summarized

In every instance the average strength of the treated specimens was found to be greater than that of the untreated specimens. The increase of strength with Ottawa sand mortar was 16 percent; that with common river sand, 31 percent.

Results of the third series of tests indicate that the increase in strength is not merely temporary, for the advantage was maintained over a period of six weeks, even though optimum curing conditions prevailed.

It is of interest to note that prehydration pressures greater than 30 psi, used for some of the specimens in the first two series, gave lower rather than higher strengths. The writer's explanation for this is that the higher pressures force more water into the cement particles than they are able to retain. When the pressure is released, this surplus water begins to bleed out in an attempt to reach a state of equilibrium. This bleeding process probably takes considerable time, and in the interim the structure of the cement begins to form. The internal movement of water would no doubt partially destroy the structural formation of the cement, resulting in loss of strength.

It is the writer's opinion that the application of a partial vacuum would remedy this trouble. It is further believed that if alternating pressure and vacuum were applied, the cement would be leached, increasing its degree of utilization to such an extent as to increase the strength of the resulting product by 50 percent or more.

Saving time and money in map reproduction

PAUL J. DUBE, Cartographic Engineer, Nevada Department of Highways, Carson City, Nev.

A method of reproducing maps and other drawings which conserves both time and money has been employed by the Nevada Department of Highways since 1949. It involves the use of Autopositive film and stick-up lettering, and is described in brief in the following paragraphs.

Here in Nevada, as in the other states, we compile a series of planimetric county and state maps in cooperation with the U. S. Bureau of Public Roads. Before 1949 we used the reproduction method generally employed at that time. After the map data had been traced on linen sheets, cultural items were inked in and lettering was done either freehand or using Leroy or Wrico lettering. From the finished tracings, Vandyke negatives were run, and finally blueline prints on paper stock. This method entailed two steps of wet processing and was both time consuming and expensive.

The stick-up lettering we use now, provides clearly printed impressions on cellophane, coated on the under side with wax adhesive, which adheres when pressure is applied—by burnishing with a small burnisher. The only other tool needed in applying the lettering is a stripping knife, or a sharp needle, to cut out the letters or words. The transparent stick-up medium permits the names to be placed without interference with drafted material. Also, it is easy to curve the lettering as dedesired, for instance to follow the sinuosities of a drainage pattern.

While the stick-up lettering is being applied, all parts of the tracing not being worked on are kept covered with 0.003-in. matte acetate sheeting. This serves two purposes. First, it is important that stick-up lettering be kept very clean. Small quantities of wax, which readily gather dirt and grime, are forced from under the stick-up during burnishing. Such dirt is opaque and if present will produce a shadow at the next stage of reproduction. Second, omissions or corrections are noted on the matte acetate, which thus serves as a check sheet.

The lettering work progresses from top to bottom of the tracing. All stippled boundary and incorporated city patterns are burnished in place, and cultural symbols are stuck down adjoining roadbands. The last phases of the stick-up work are the burnishing in place of the legend sheet, title block, key to counties and county sheet numbers, north arrow, scale, and marginal title.

After thorough checking, the tracing is carefully cleaned with carbon tetrachloride to remove any dirt which may adjoin the wax-backed stick-ups. Now the tracing is ready for the next step—duplication of the map.

Two Autopositive films are made of each tracing in a portable vacuum frame which is exposed to sunlight. Sunlight exposure is preferred because of the ease in obtaining even light diffusion.

The heavy-line work is then added to both Autopositive film copies. The reason for adding the heavy-line detail on the film is to facilitate future revision of the original tracings. Such revision is simpler if there are no heavy-weight lines to be removed or changed.

One of the two Autopositive films is held for base-map needs. Road types are inked on the second copy—and the map is complete. By processing in this manner, we are able to hold contact with the emulsion side of the Autopositive film at every stage of reproduction, which is extremely important in achieving clean, sharp final runs.

The completed Autopositive film is placed in the hands of a commercial printing company. Using the film as the photographic copy, negatives are run, plates exposed, and the maps printed in an offset press. An Autopositive film will make a denser, sharper, and cleaner contact print than the original tracing sheet. It can be run through a hot contact printer without buckling, sticking, or changing scale. It is highly stable dimensionally. In addition, it is a very superior medium for photographic reproduction and offset press runs

The very rapid print-back speed of Autopositive film permits production of true-to-scale map sheets in a large-diameter cylinder blueprint machine in a relatively short time. It has made it possible for us to overcome a difficult map reproduction problem with relative ease. Elimination of two "wet" stages has resulted in a tremendous saving in man-hours, and our final costs for reproducing map sheets have been reduced from approximately one dollar to about 25 cents per sheet.

THE READERS WRITE

Ground-Water Recharge Recommended for Florida

To the Editor: Sherman Chase's fine article in the July issue, about Miami's pollution problem, reveals continued heavy water demand. The Hialeah wells are now asked to produce a mere 60 mgd. The new Virginia Key outfall is to be designed to handle 153 mgd. With Miami setting the pace, we have a picture of the Everglades' generous waters pumped and drained to the sea without limit along the "Gold Coast."

In southeast Florida we have an example of nature in fine balance. In a sense this area manufactures its own rainfall and climate. Localized thunderstorms are a large proportion of the rainfall and the expanse of interior glades with Lake Okeechobee exert a moderating influence on the winters.

Can we upset this natural balance? What would a decrease in average winter temperatures and a decrease in average annual rainfall do to south Florida's agricultural and tourist economy? Could a minor influence to upset the balance start a chain of events that would adversely affect climate and moisture? Florida's engineers and all those interested in her economy may well look for the answers and safeguard the natural balance.

When will it be time to consider recharge? When will we utilize our advancing knowledge of sewage treatment to turn our outfalls from the sea to the interior glades? In southern California we are already learning the hard way about recharge. Will we wait too long in south Florida and risk the loss of not only ground water but climate as well?

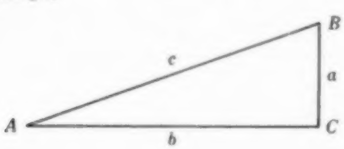
Ross F. Sweeny, A.M.ASCE
Engineer, National Park Service
Richmond, Va.

Laying Out Angles with Steel Tape Alone

To the Editor: In his article, "Angles Laid Out in Field with Steel Tape Alone" (August 1953, p. 63), Marvin Gates presents an interesting solution for a commonly met surveying problem.

While holding the position of a Construction Surveyor for the Corps of Engineers in Korea, I was often faced with the problem of laying out angles in weather too severe to expose even badly battered transits. The solution I used produced results comparable to those obtained by Mr. Gates, but was based on a series of computations that were more easily made than those outlined by him. The method is also more widely applicable since the tape used need not be graduated throughout its length.

If it is desired (as in Mr. Gates' problem) to lay out an angle of 23°06', a base line AC is measured 50.00 ft long. Then in the triangle,



$$c = \frac{50.00}{\cos A} = \frac{50.00}{0.91982} = 54.36 \text{ ft}$$

$$a = 50.00 \tan A = 50.00\,(0.42654) = 21.33 \text{ ft}$$

The zero end of the tape is held at point A and the 100-ft end at point C. By the use of these simple computations, looping, crossing, and applying tension to the tape, point B can be located.

Actual readings on the tape at each point are dependent on the manner in which the tape is graduated. For example, if the tape is graduated between the zero and 1-ft marks and the 99- and 100-ft marks, then with the 0.64-ft mark at point A, and the 99.33-ft mark held at point C, point B is located by the intersection of the 55- and 78-ft marks. If the tape is graduated outward from the zero and 100-ft marks, then the graduations held at each point must be recomputed.

If the tape is graduated only in the first or last foot, then this method must be altered. In this case the side BC must be made equal to an exact number of feet, and its length is chosen as 25.00 ft. Then

$$b = \frac{25.00}{\tan A} = \frac{25.00}{0.42654} = 58.61 \text{ ft}$$

$$c = \frac{25.00}{\sin A} = \frac{25.00}{0.39234} = 63.72 \text{ ft}$$

The line AC is then measured as 58.61 ft long. If the tape is graduated between the zero and 1-ft marks then the 0.28-ft mark is held at point A, the 100-ft mark is held at point C, and the intersection of the 64- and 75-ft marks locates point B. If the tape is graduated between the 99- and 100-ft marks then the 99.72-ft mark is held at point A, the zero mark is held at point C, and the intersection of the 25- and 36-ft marks locates point B.

This supplemental method is offered, not in rebuttal, but as a well-tested field expedient.

Paul A. Parisi, J. M. ASCE
Assistant Editor, Technical Publications, ASCE
New York, N.Y.

1953 ANNUAL CONVENTION

New York, N. Y., Statler Hotel, October 19–23, 1953

GENERAL THEME—MASS TRANSPORTATION

REGISTRATION

Convention Rotunda, Statler Hotel

Opens 9:00 a.m. Monday, October 19; each Convention day 9:00 a.m. to 5:00 p.m.

Registration fee (except ladies and students) $2.50.

AUTHORS' BREAKFASTS

Parlor 2 Statler Hotel

Monday, October 19, 8:15 a.m.
Tuesday, October 20, 8:15 a.m.
Wednesday, October 21, 8:15 a.m.
Thursday, October 22, 8:15 a.m.

Briefing sessions for speakers, discussers and program officials by invitation. Presiding: J. M. Garrelts, Vice Chairman, Annual Convention Committee.

MONDAY MORNING OCT. 19

Surveying and Mapping Division

9:30 a.m. Skytop

Presiding: H. B. Aikin, Chairman, Executive Committee, Surveying and Mapping Division

9:30 **Maps and Surveys—Vital to the Solution of Problems of Mass Transportation**
B. E. Beavin, Sr., Member, Executive Committee, Surveying and Mapping Division

10:00 **Discussion**

10:30 **The Importance of Maps and Surveys to the Location, Design, and Construction of Large Pipelines**
Ford Bartlett, M. ASCE, President, Lockwood, Kessler & Bartlett, Great Neck, N.Y.

TRANSPORTATION THEATER

Parlor 1 9:00–5:00, Monday–Thursday

In portraying the theme selected for this Annual Convention—Mass Transportation—a motion picture theater will operate throughout the Convention days. Selected films will portray new developments in each field of transportation. Continuous showings, as scheduled, will provide opportunity to view the outstanding current films prepared by private industry, public agencies, and commercial producers. See schedule in registration foyer.

Waterways Division

9:30 a.m. Keystone

Presiding: W. O. Hiltabidle, Jr., Chairman, Waterways Division

9:30 **Navigation Problems of the Irrawadi River System in Burma**
John Alexander, M. ASCE; and Henry R. Norman, M. ASCE; Knappen - Tippetts - Abbett - McCarthy, New York, N.Y.

10:00 **Moorings at Piers and Streams**
K. M. Bowman, Structural Section, Bureau of Yards and Docks, U.S. Navy, Washington, D.C.

10:30 **Wind Generation of Waves in Waters of Intermediate Depth**
L. T. Loft, Amphibious Construction Battalion No. 2, U.S. Navy

Sanitary Engineering Division

9:30 a.m. Ballroom

Presiding: H. B. Gotaas, Chairman, Executive Committee, Sanitary Engineering Division; and J. C. Bumstead, Secretary, Executive Committee, Sanitary Engineering Division.

9:30 **Meeting opened by**
H. B. Gotaas, Chairman, Sanitary Engineering Division.

9:35 **Water Supply and Purification Committee Report**
E. Whitlock, M. ASCE, Malcolm Pirnie Engineers, New York, N.Y.

9:55 **Discussion**

10:05 **Special Design Features of Water Works Facilities Handling Highly Turbid Waters**
R. G. Kincaid, A.M. ASCE, Burns & McDonnell, Kansas City, Mo.

10:35 **Design Features of Modern Water Treatment Plants for Handling Low-Turbidity Water**
R. Ritter, M. ASCE, Whitman, Requardt & Assoc., Baltimore, Md.

11:05 **Formal discussion**
Charles H. Capen, M. ASCE, Chief Engineer, North Jersey District Water Supply Commission, Wanaque, N.J.

11:15 **General discussion**

11:30 **Water and Sewage Problems of a City in the Making, Levittown, Pa.**
A. A. Estrada, A.M. ASCE, Albright & Friel, Philadelphia, Pa.

12:00 **Discussion**

HIGHWAY LUNCHEON

Monday, Oct. 19 Georgian Room 12:00 p.m.

Sponsored by the Highway Division

Speaker: Bertram D. Tallamy, M. ASCE, Chairman, New York State Thruway Authority.

Subject: Organization and Operating Procedures of the N.Y.S.T.A.

Toastmaster: G. Donald Kennedy, M. ASCE, Chairman, Highway Division, ASCE.

All members, guests and friends of ASCE are cordially invited to attend this luncheon, sharing the topic of timely interest.

Per plate $3.50.

BOARD-LOCAL SECTION LUNCHEON

Monday, Oct. 19 Penn Top North 12:30 p.m.

A "get acquainted" event for members of the ASCE Board of Direction and delegates attending the Local Sections Conference.

Per plate $3.50.

MONDAY AFTERNOON

OCT. 19

Highway and Construction Divisions—Joint Session

2:30 p.m **Georgian Room**

Presiding: De Witt C. Greer, Member, Executive Committee, Highway Division

The New York State Thruway Authority

2:30 **Economic Feasibility**

ELMER IZAAK, Madigan & Hyland, Long Island City, N.Y.

3:00 **Design Standards, Construction Schedule and Problems**

J. B. MCMORRAN, A.M. ASCE, Chief Engineer, N.Y. State Dept. of Public Works, Albany, N.Y.

3:30 **Design of Pavement**

C. H. LANG, M. ASCE, Deputy Chief Engineer, N.Y. State Thruway Authority, N.Y. State Dept. of Public Works, Albany, N.Y.

4:00 **Bridge and Overpass Design Features and Problems**

E. W. WENDELL, M. ASCE, N.Y. State Dept. of Public Works, Albany, N.Y.

Power Division

2:30 p.m. **Keystone Room**

Presiding: M. G. Salzman, Member, Executive Committee, Power Division

2:30 **Growth in Concrete as Related to Power Plant Structures**

STANLEY MOYER, M. ASCE, Mechanical Engineer, Philadelphia Electric Co., Philadelphia, Pa.

Discussions

H. A. KAMMER, A.M. ASCE, American Gas & Electric Co., New York, N.Y.

E. A. WOODHEAD, Idaho Power Co., Boise, Idaho

3:40 **Recent Additions and Improvements to the Hales Bar Dam and Power Plant**

ADOLPH A. MEYER, M. ASCE, Head Civil Design Engineer, TVA, Knoxville, Tenn.

Discussion

NORMAN F. WILLIAMS, M. ASCE, Southern Services Inc., Birmingham, Ala.

Sanitary Engineering Division

2:00 p.m. **Ballroom**

Presiding: Ralph Fuhrman, Member, Executive Committee, Sanitary Engineering Division; and Rolf Eliassen, Member, Executive Committee, Sanitary Engineering Division

2:00 **Sewage Aeration Practice in New York City**

R. H. GOULD, M. ASCE, Director, Div. of Sewage Disposal, Dept. of Public Works, New York, N.Y.

2:30 **Sewage Aeration Practice in the Sanitary District of Chicago**

N. E. ANDERSON, M. ASCE, Engineer of Treatment Plant Design, The Sanitary District of Chicago, Chicago, Ill.

3:00 **Formal discussion**

ROLF ELIASSEN, M. ASCE, Professor, Sanitary Engineering, M.I.T., Cambridge, Mass.

3:10 **General discussion**

3:25 **Waste Disposal Problems at Fairless Works of U.S. Steel Corp.**

R. NEBOLSINE, M. ASCE, President, Hydrotechnic Corp., New York, N.Y

3:40 **Sheet and Tin Mill Waste Disposal at Fairless Works**

C. H. MACDOUGALL, A.M. ASCE, Chief Engineer, Hydrotechnic Corp., New York, N.Y.

4:00 **Flue Dust Treatment at Fairless Works**

A. D. HENDERSON, Vice-President, Hydroelectric Corp., New York, N.Y.

J. J. BAFFA, A.M. ASCE, Consulting Engineer, New York, N.Y.

4:10 **Sanitary Sewage Treatment at Fairless Works**

J. J. BAFFA, A.M. ASCE, Consulting Engineer, New York, N.Y.

4:20 **Terminal Treatment Plant at Fairless Works**

C. JOST, Buck, Seifert & Jost, New York, N.Y.

4:40 **General discussion**

Soil Mechanics and Foundations Division

Jointly Sponsored by U.S. National Council on Soil Mechanics and Foundation Engineering

2:30 p.m. **Sky Top**

Presiding: Hibbert M. Hill, Chairman, Executive Committee, Soil Mechanics and Foundations Division

2:30 **Field Control for Sand Drains**

STEPHEN OLKO, J.M. ASCE, Soils Engineer, Frederic R. Harris, Inc., New York, N.Y.

3:15 **Accelerated Traffic Tests for Newark Airport**

MARTIN KAPP, J.M. ASCE, Soils Engineer, Port of New York Authority, New York, N.Y.

4:10 **Estimating True Behavior of Clay from Laboratory Test Results**

JOHN SCHMERTMANN, J.M. ASCE, Junior Soils Engineer, Moran, Proctor, Mueser & Rutledge, New York, N.Y.

WATERWAYS DIVISION TOUR

Monday, Oct. 19 **2:00 p.m.**

Pier 57

New and most unusual is Pier 57, under construction on the North River, to be visited under sponsorship of the Waterways Division. The pier is located at the foot of West 15th Street, such a short distance from the hotel that no group transportation has been arranged. No charge for this excursion.

LADIES TOUR OF THE STOCK EXCHANGE

Monday, Oct. 19 **2:15 p.m.**

A conducted tour of the largest stock trading center of the world, the New York Stock Exchange. Facility of transportation from the hotel direct to the Exchange makes group transportation unnecessary. No charge for this excursion. Numerous historic restaurants in this area.

CONSULTANTS' DINNER

Monday, Oct. 19 **6:45 p.m.**

Keystone Room

Annual Dinner of the American Institute of Consulting Engineers

Past and present officers of the American Society of Civil Engineers are invited. Ladies are welcome. Subscription, $13.50 per person. For information and reservations, apply to AICE Headquarters, Room 401, Engineering Societies Building, 33 West 39th Street, New York 18, N.Y. (Telephone—LOngacre 3-4849, before noon on October 19).

LOCAL SECTIONS CONFERENCE

Monday and Tuesday, Oct. 19–20

9:30 a.m. **Parlor 2**

Representatives of Local Sections of ASCE in the northeast area will convene for discussion of expanding

activities of the Sections. The conference, which is primarily for invited delegates of selected Sections, will be open to all persons who may be interested in the activities and operational details of ASCE Local Sections.

TUESDAY MORNING

OCT. 20

Engineering Mechanics Division

9:30 a.m. **Keystone Room**

9:30 **Numerical Analysis of Frames with Curved Girders**
JAMES MICHALOS, M. ASCE, Dept. of Civil Engineering, Iowa State College, Ames, Iowa

10:00 **Transients and Their Solution by Impulse Momentum**
ELIO D'APPOLONIA, A.M. ASCE, Dept. of Civil Engineering, Carnegie Inst. of Technology, Pittsburgh, Pa.

10:30 **Lateral Buckling of Cantilevered I-Beams Under Uniform Loads**
STANLEY POLEY, J.M. ASCE, student, Graduate School of Civil Engineering, Columbia University, New York, N.Y.

11:00 **Deflection Theory for Laminated Beams Composed of Two or More Laminations**
L. G. CLARK

Highway, Construction, Soil Mechanics and Foundations, and Structural Divisions—Joint Session

9:30 a.m. **Georgian Room**

Presiding: Roy E. Jorgensen, Member, Executive Committee, Highway Division

9:30 **Nyack-Tarrytown Bridge—Foundation Problems, General Design and Structural Features**
EMIL H. PRAEGER, M. ASCE, Madigan & Hyland, Long Island City, N.Y.

10:30 **Foundation Problems—Crossing Montezuma Swamp, Genesee River, and Lake Onondaga**
GEORGE W. MCALPIN, JR., A.M. ASCE, Director, Bureau of Soil Mechanics, N.Y. State Dept. of Public Works, Albany, N.Y.

Sanitary Engineering Division

9:30 a.m. **Ballroom**

Presiding: Ray L. Derby, M. ASCE, Principal Sanitary Engineer, City Department of Water and Power, Los Angeles, Calif.; and A. J. Fischer, A.M. ASCE, Assistant Manager, Development Dept., the Dorr Co., Stamford, Conn.

9:30 **Refuse Collection and Disposal Committee Report**
H. W. TAYLOR, M. ASCE, Consulting Engineer, New York, N.Y.

9:50 **Discussion**

10:00 **Stabilization of Municipal Refuse by Composting**
P. H. MCGAUHEY, M. ASCE, Research Engineer, Univ. of California
H. B. GOTAAS, Chairman, Executive Committee, Sanitary Engineering Division

10:30 **Preliminary Report on High-Rate Composting Research at Michigan State College**
J. R. SNELL, A.M. ASCE, Head, Dept. of Civil Engineering, Michigan State College, East Lansing, Mich.

10:50 **Frazer-Eweson Digester Process for Garbage Composting**
ERIC EWESON, Frazer Products, Inc., Newport, R.I.

11:10 **Oakland Method of Garbage Composting**
R. STOVROFF, President, Compost Corp. of America, San Francisco, Calif.

11:40 **General discussion**

SOIL MECHANICS LUNCHEON

Tuesday, Oct. 20 **12:30 p.m.**

Georgian Room

Sponsored by Soil Mechanics and Foundations Division

Presiding: ARTHUR CASAGRANDE, Member, Executive Committee, Soil Mechanics and Foundations Division

All members, guests and friends of ASCE are cordially invited to attend.

Per plate $3.50.

TUESDAY AFTERNOON

OCT. 20

Engineering Mechanics and Structural Divisions—Joint Session

2:30 p.m. **Keystone Room**

Presiding: N. M. Newmark, Chairman, Executive Committee, Engineering Mechanics Division

2:30 **Post Buckling Strength of Redundant Trusses**
E. F. MASUR, Civil Engineering Dept., Illinois Inst. of Technology, Chicago, Ill.

3:00 **Design of Composite Thin Shells**
M. G. SALVADORI, A.M. ASCE, Civil Engineering Dept., Columbia University, New York, N.Y.

3:30 **Designing Aluminum Alloy Members for Combined End Load and Bending**
E. C. HARTMANN, M. ASCE; H. M. HILL, M. ASCE; and J. W. CLARK, J.M. ASCE; Aluminum Co. of America, New Kensington, Pa.

4:30 **The Safety Factor in Relation to Service and Failure of Structures**
A. M. FREUDENTHAL, M. ASCE, Civil Engineering Dept., Columbia University, New York, N.Y.

Sanitary Engineering Division

2:00 p.m. **Ballroom**

Presiding: B. A. Poole, Member, Executive Committee, Sanitary Engineering Division; and J. Baffa, A.M. ASCE, Consulting Engineer, New York, N.Y.

2:00 **Sludge Thickening at Pittsburgh by Laboon Process**
J. F. LABOON, M. ASCE, Allegheny County Sanitary Authority, Pittsburgh, Pa.

2:30 **Sludge Thickening at New York City by Torpey Process**
W. N. TORPEY, Senior Civil Engineer, Div. of Sewage Disposal, Dept. of Public Works, New York, N.Y.

3:00 **Discussion**

3:30 ***Professional Development and Management***

Planning and Executing a Uniform Pollution Abatement Program for the Kansas River Basin
D. F. METZLER, M. ASCE, Chief Engineer and Director, Div. of Sanitation, Kansas State Board of Health, Lawrence, Kans.

Cooperation Between Industries and Regulatory Agencies
J. E. KINNEY, A.M. ASCE, Sanitary Engineer, Ohio River Valley Water Sanitation Commission, Cincinnati, Ohio.

Public Relations Aspects of Consulting Sanitary Engineering Work
M. H. KLEGERMAN, A.M. ASCE, Alexander Potter Associates, New York, N.Y.

4:30 **Discussion**

Soil Mechanics and Foundations Division

Jointly Sponsored by U.S. National Council on Soil Mechanics and Foundation Engineering

2:30 p.m. **Georgian Room**

Presiding: Raymond F. Dawson, Member, Executive Committee, Soil Mechanics and Foundations Division

2:30 ***Reports on Zurich Conference***

Introductory Remarks Regarding International Organization

Donald Taylor, A.M. ASCE, Soil Mechanics Dept., Mass. Inst. of Technology, Cambridge, Mass.

2:45 **Remarks on U.S. National Council**

A. E. Cummings, M. ASCE, Director of Research, Raymond Concrete Pile Co., New York, N.Y.

3:00 ***Reports on Significant Developments in Each of the Eight Divisions of Swiss Conference***

Theories and Hypotheses

A. Casagrande, M. ASCE, Professor of Soil Mechanics and Foundation Engineering, Harvard University, Cambridge, Mass.

Laboratory Investigations

S. J. Buchanan, M. ASCE, Professor, Soil Mechanics, A. & M. College of Texas, College Station, Tex.

Field Investigations

W. J. Turnbull, M. ASCE, Member, Executive Committee, Soil Mech. and Foundations Division

Foundations

Ralph B. Peck, M. ASCE, Talbot Laboratory, Univ. of Illinois, Urbana, Ill.

Roads and Runways

S. J. Buchanan, M. ASCE.

Earth Pressures

Karl Terzaghi, Hon.M. ASCE, Professor of Civil Engineering, Harvard University, Cambridge, Mass.

Slopes and Earth Dams

A. Casagrande, M. ASCE.

Résumé and Overall Evaluation

Karl Terzaghi, Hon.M. ASCE.

NEW YORK STATE THRUWAY EXCURSION

Tuesday, Oct. 20
12:30 p.m. to 5:00 p.m.

Inspection trip of Thruway under construction. This bus tour is under the sponsorship of the Highway Division. See registration-desk bulletin board for points to be visited.

WEDNESDAY MORNING

OCT. 21

First Annual Business Meeting Following the Centennial

10:30 a.m. **Georgian Room**

Presiding: Walter L. Huber, President, American Society of Civil Engineers

10:30 **Annual Reports of Board of Direction, Secretary and Treasurer**

Report of Tellers on Canvass of Ballot for Officers

Introduction of New Officers:

Director, District 1—William S. La-Londe, Jr.

Director, District 4—Oliver W. Hartwell

Director, District 8—Thomas C. Shedd

Director, District 11—Samuel B. Morris

Director, District 14—Ernest W. Carlton

Director, District 15—Raymond F. Dawson

Vice President, Zone I—Enoch R. Needles

Vice President, Zone IV—Mason G. Lockwood

President—Daniel V. Terrell

New Business

11:00 **Presentation of Awards**

Norman Medal to L. W. Teller, M. ASCE, and Friedrich Bleich, deceased

J. James R. Croes Medal to Paul Rogers, M. ASCE

Thomas Fitch Rowland Prize to E. Montford Fucik, M. ASCE

James Laurie Prize to Harold N. Fisk

Arthur M. Wellington Prize to Louis A. Nees, A.M. ASCE

Collingwood Prize for Junior Members to Kuang-Han Chu, A.M. ASCE

Construction Engineering Prize to Ben C. Gerwick, Jr., A.M. ASCE

Karl Emil Hilgard Prize to Arthur T. Ippen, M. ASCE

Rudolph Hering Medal to William F. Garber and Ralph Stone, A.M. ASCE

Leon S. Moisseiff Award to Arthur W. Anderson; John A. Blume, M. ASCE; Henry J. Degenkolb, M. ASCE; Harold B. Hammill, M. ASCE; Edward M. Knapik, M. ASCE; Henry L. Marchand; Henry C. Powers; John E. Rinne, M. ASCE; George A. Sedgwick, A.M. ASCE; Harold O. Sjoberg, A.M. ASCE

Scrolls of appreciation to Sydney Wilmot, M. ASCE

11:30 **Installation of Daniel V. Terrell as President of ASCE, and President's Keynote Address**

Adjournment for Membership Luncheon

ANNUAL MEMBERSHIP LUNCHEON

Wednesday, Oct. 21 **12:30 p.m.**
Ballroom

Speaker: Ralph H. Tudor, M. ASCE, Undersecretary of Interior

Toastmaster: Raymond L. Brandes, Chairman, Annual Convention Committee

All members, their ladies, guests and friends of ASCE are cordially invited to attend this luncheon and to share timely observations by a civil engineer and administrator of national prominence.

Per plate $4.00.

SANITARY ENGINEERING DINNER

Tuesday, Oct. 20 **6:30 p.m.** **Georgian Room**

All members, their ladies, guests and friends of ASCE are cordially invited to attend this special event, signaling the expanded program of the Division.

WEDNESDAY AFTERNOON

OCT. 21

STUDENT CHAPTER CONFERENCE

Wednesday, 2:30 p.m. **Skytop**

Open meeting of students from ASCE Chapters, Faculty Advisers, Contact Members, and others interested in the Student Chapter program of the Society.

The Metropolitan Conference of ASCE Student Chapters is spon-

soring this meeting. The program will feature participation of students and practicing engineers.

Construction Division

2:30 p.m. — Penn Top

Development of Cerro Bolivar Project, Venezuela, Orinoco Mining Company

2:30 **Description of Project**
W. W. Wanamaker, M. ASCE, Chief Engineer, Orinoco Mining Co., New York, N.Y.

3:00 **Railroad Construction**
George R. Barlow, A.M. ASCE, Morrison-Kundsen Co., Inc., New York, N.Y.

3:30 **River Improvement**
Walter H. Gahagan, President, Gahagan Construction Co., New York.

4:00 **Ore Handling**
L. O. Millard, Asst. Sales Manager, Link Belt Co., Chicago, Ill.

4:30 **Wharf Construction**
Howard P. Maxton, M. ASCE, Vice President, DeLong Construction Co., New York, N.Y.

Engineering Mechanics Division

2:30 p.m. — Keystone Room

2:30 **Experimental Verification of the Hydrodynamic Theory for Oblique Standing Waves**
A. T. Ippen, M. ASCE, and D. R. F. Harleman, J.M. ASCE, Hydrodynamics Laboratory, Mass. Inst. of Technology, Cambridge, Mass.

3:15 **A New Approach to Turbulent Boundary Layer Problems**
Donald Ross

3:45 **Flow Into Wells in Unconfined Aquifer by Electric and Membrane Analogy**
C. H. Zee, D. F. Peterson and R. O. Bock

4:15 **An Experimental Study of the Motion of Gas Bubbles in Various Liquids**
W. L. Haberman and R. K. Morton

Sanitary Engineering Division

2:30 p.m. — Ballroom

Presiding: Roy J. Morton, Member, Executive Committee, Sanitary Engineering Division; W. T. Ingram, M. ASCE, Public Health Engineering Dept., New York University, New York, N.Y.; and D. A. Okum, A.M. ASCE, Sanitary Engineering Dept., University of North Carolina, Chapel Hill, N.C.

2:30 **Sanitary Engineering Aspects of Atmospheric Pollution**
L. C. McCabe, U.S. Bureau of Mines, Washington, D.C.

3:00 **Air Pollution Abatement in New York City**
L. Greenburg, Commissioner, Dept. of Air Pollution Control, New York, N.Y.

3:30 **Air Pollution Studies, New York City Transit System**
J. H. Griffin, M. ASCE, Chief Engineer, Transit Authority, New York, N.Y.

3:45 **Atmospheric Pollution Control in the Port of New York Authority Tunnels**
R. F. Schaefer, M. ASCE, Engineer of Design, The Port of New York Authority, New York, N.Y.

4:15 **General discussion**

4:45 **Closing announcements, Chairman of Executive Committee**

Introduction of Incoming Chairman

Soil Mechanics and Foundations Division

Jointly Sponsored by U.S. National Council on Soil Mechanics and Foundation Engineering

2:30 p.m. — Georgian Room

Presiding: Robert F. Blanks, Member, Executive Committee, Soil Mechanics and Foundations Division

2:30 **Development of Facilities for Evaluating Load-Carrying Capacity of Dog-Legged Piles**
S. D. Wilson, A.M. ASCE, Harvard University, Cambridge, Mass., and James Parsons, M. ASCE, Moran, Proctor, Mueser & Rutledge, New York, N.Y.

3:15 **Analysis of Reaction of Piles to Lateral Loads**
John Lowe, A.M. ASCE, Knappen-Tippetts-Abbett-McCarthy, New York, N.Y.

4:00 **The Structure of Inorganic Soil**
T. W. Lambe, J.M. ASCE, Assistant Professor of Soil Mechanics, Mass. Inst. of Technology, Cambridge, Mass.

Structural Division

2:30 p.m. — Sky Top

Presiding: R. N. Bergendoff, Member, Executive Committee, Structural Division

2:30 **Automatic Joint Translation by Cantilever Moment Distribution**
L. E. Grinter, M. ASCE, Dean, Graduate School, University of Florida, Gainesville, Fla.; and C. H. Tsao.

3:00 **Examples of Timber Structure Failure**
Michael N. Salgo, M. ASCE, 3rd Naval District Headquarters, New York, N.Y.

3:30 **The Fairless Works of U.S. Steel Corporation**
Harry S. Spitz, Chief Engineer, Fairless Works

ANNUAL DINNER AND DANCE

President's Reception and Award of Honorary Membership

Wednesday Evening — Statler Ballroom

6:30 **Assembly and cocktails, Rotunda**

7:30 **Dinner, Ballroom**

9:00 **Award of Honorary Membership**

9:30 **President's Reception and dancing**

Dinner music, dance music, entertainment

For this event, special arrangements can be made for reservation of tables seating 10 persons. Members may underwrite complete tables, or pool reservations with others. Orders for tables must be accompanied by check in full and a list of guests.

The published seating list will close at 5:00 p.m., Tuesday, October 20. Tickets purchased after this hour will be assigned to tables in order of purchase. Sales of tickets will be limited to capacity of Ballroom.

Per plate, $10.00. Dress, formal.

THURSDAY MORNING OCT. 22

Construction Division

9:30 a.m. — Penn Top South

9:30 **Detroit-Toledo Expressway**
H. C. Coons, M. ASCE, Deputy Commissioner and Chief Engineer, Michigan State Highway Dept., Lansing, Mich.

10:15 **Detroit-Chicago Thruway**

10:45 **Construction films on both project**

Hydraulics Division

9:30 a.m. — **Georgian Room**

Presiding: Carl E. Kindsvater, Chairman, Committee on Research, Hydraulics Division

9:30 **Wave Forces on Offshore Structures**
C. L. BRETSCHNEIDER, A.M. ASCE, Dept. of Oceanography, Texas A. & M. College, College Station.

10:00 **Traveling Waves in Channels of the Overrun, Slug, or Surge Type**
PAUL BAUMANN, M. ASCE, Los Angeles County Flood Control District, Los Angeles, Calif.

10:30 **The Shape Factor in the Design of Sedimentation Tanks**
ALFRED C. INGERSOLL, A.M. ASCE, Civil Engineering Dept., Calif. Inst. of Technology, Pasadena, Calif.

11:15 **The Effect of Compartmentalization on Efficiency of Flocculation**
W. J. KAUFMAN, J.M. ASCE, Engineering Math. Lab., University of California, Berkeley, Calif.

Structural Division

9:30 a.m. — **Sky Top**

Presiding: Raymond Archibald, Chairman, Executive Committee, Structural Division

9:30 **Lateral Buckling of I-Beams Under Thrust and Unequal End Moments**
M. G. SALVADORI, A.M. ASCE, Dept. of Civil Engineering, Columbia University, New York, N.Y.

10:00 **Mackinac Straits Bridge**
D. B. STEINMAN, M. ASCE, Consulting Engineer, New York, N.Y.

10:30 **An Engineering Approach to Blast Resistant Design**
NATHAN M. NEWMARK, M. ASCE, Research Professor, Structural Engineering, Univ. of Ill.

11:00 **Design Features of Livestock Judging Pavilion at Raliegh, N.C.**
FRED N. SEVERUD, M. ASCE, Partner, Severud, Elstad, Kruger, New York, N.Y.

City Planning Division

9:30 a.m. — **Keystone Room**

Presiding: Leslie Williams, Chairman, Executive Committee, City Planning Division

9:30 **Organization for Metropolitan Traffic and Transportation Planning**
CHARLES A. BLESSING, M. ASCE, Vice Chairman, City Planning Div.

10:00 **Discussion**
HUBER SMUTZ, Member, Executive Committee, City Planning Division.

10:30 **Transit Improvements Since World War II**
GEORGE ANDERSON, Executive Director, American Transit Association, New York, N.Y.

11:00 **Is Parking a Public or Private Responsibility?**
C. T. MACGAVIN, Director, National Parking Association, Washington, D.C.

11:30 **Discussion**

STUDENT CHAPTER FACULTY ADVISERS CONFERENCE

Thursday, Oct. 22 — **9:30 a.m.**

Parlor 2

Presiding: Robert H. Dodds, Chairman, Committee on Student Chapters

Faculty advisers of Student Chapters of ASCE in the northeast area will convene upon invitation for discussion of operation of the Chapters.

This conference, which is primarily for advisers of selected Chapters, will be open to any and all who may be interested in the activities of ASCE in the colleges.

MASS TRANSPORTATION LUNCHEON

Thursday, Oct. 22 — **12:30 p.m.**

Ballroom

Sponsored by Construction Division

Speaker: MARCUS NADLER, Economist, Central Hanover Bank and Trust Co.

Subject: Mass Transportation—Can We Afford It?

Toastmaster: ARTHUR E. POOLE, Chairman, Executive Committee, Construction Division.

All members, guests and friends of ASCE are cordially invited to attend this luncheon.

Per plate, $3.50.

THURSDAY AFTERNOON OCT. 22

Construction, Structural, Highway Divisions—Joint Session

2:30 p.m. — **Ballroom**

Presiding: Arthur E. Poole, Chairman, Construction Division; and Maurice N. Quade, Member, Executive Committee, Structural Division

2:30 **Design of Chesapeake Bay Bridge**
R. A. GILMORE, M. ASCE, J. E. Greiner Co., Baltimore, Md.

3:00 **Construction of Main Bridge Piers**
EUGENE RAU, J. Rich-Steers Construction Co., New York, N.Y.

3:30 **Construction of Superstructure**
ETHAN F. BALL, M. ASCE, Bethlehem Steel Corp., Bethlehem, Pa.

4:00 **Design of Delaware Aqueduct**
STANLEY H. DORE, M. ASCE, Asst. Chief Engineer, Board of Water Supply, New York, N.Y.

4:30 **Construction of East Branch Tunnel**
CHARLES D. RIDDLE, A. M. ASCE, Chief Engineer, Walsh Construction Co., New York, N.Y.

5:00 **Motion Pictures, construction of Chesapeake Bay Bridge**

Engineering Mechanics Division

Session on Plasticity

2:30 p.m. — **Keystone Room**

2:30 **Introductory Comments on Applications of Plastic Analysis in Structural Design**
BRUCE JOHNSTON, M. ASCE, Dept. of Structural Engineering, University of Michigan, Ann Arbor, Mich.

3:00 **Plastic Buckling of Eccentrically Loaded Aluminum Alloy Columns**
J. W. CLARK, J.M. ASCE, Aluminum Co. of America, New Kensington, Pa.

3:30 **On the Question of Net Section**
W. G. BRADY and D. C. DRUCKER, A.M. ASCE, Secretary, Executive Committee, Engineering Mechanics Division

4:00 **Plastic Deformation of Wide-Flange Beam Columns**
ROBERT L. KETTER, J.M. ASCE, Research Asst., Lehigh University; and LYNN S. BEEDLE, A.M. ASCE, Asst. to Director, Fritz Engineering Lab., Lehigh University, Bethlehem, Pa.

4:30 **Plastic Buckling of Eccentrically Loaded Elastically Restrained Columns**
GEORGE WINTER, M. ASCE, Head, Dept. of Structural Engineering, Cornell University, Ithaca, N.Y.

Hydraulics Division

2:30 p.m. — **Georgian Room**

Presiding: George H. Hickox, Vice Chairman, Executive Committee, Hydraulics Division

2:30 **Discharge Characteristics of Tainter Gates**
ARTHUR TOCH, J.M. ASCE, Iowa Inst. of Hydraulic Research, Iowa City, Iowa.

3:00 **Coefficients for Spillways at TVA Dams**
KENNETH W. KIRKPATRICK, A.M. ASCE, Hydraulics Laboratory, TVA, Norris, Tenn.

3:30 **Tainter-Gate Control of Outlets at Garrison Dam**

J. H. Douma, A.M. ASCE, Office, Chief of Engineers, Washington, D.C.

4:00 **Discharge Coefficients for Gates and Valves as Determined by Field and Laboratory Studies**

C. W. Thomas, M. ASCE, Head, Hydraulic Investigations Unit, U.S. Bureau of Reclamation, Denver, Colo.

M.I.T. DINNER

Thursday, Oct. 22 **6:00 p.m.**

Parlor 2

The engineering alumni and faculty of Massachusetts Institute of Technology will meet for dinner. The program of the dinner has been planned to permit attendance at the ASCE Smoker, immediately following.

For information and reservations, call William S. LaLonde, Jr., at the Newark College of Engineering, or Edward Wininger at CI 6-9200, or see them at the Convention.

MEN'S SMOKER AND SHOW

Thursday, Oct. 22 **8:00 p.m.**

Statler Ballroom

A well earned reputation for informality, excellent entertainment, refreshments to a man's liking, and a chance to swap yarns with old friends has become attached to this ASCE Smoker.

8-9 p.m. Time to start the evening properly.

9-10 p.m. The pick of the talent from Broadway and TV.

10 p.m. Sandwiches, snacks, beer and coffee with bar service.

Note: To meet the convenience of those attending college dinners, the show has been timed so that there is no need to miss any of the acts. Also note that the ladies are being entertained elsewhere on this same evening, and won't return 'till late!

Per person, $3.50.

FRIDAY EXCURSION

OCTOBER 23

Excursion to Fairless Works

An all-day tour will be made by bus directly from the Statler Hotel, via the New Jersey Turnpike, to the Fairless Works of the U. S. Steel Corporation at Morrisville, Pa. Among the features included are:

New Jersey Turnpike
Dock and unloading facilities
Blast furnaces
Bake ovens
Open-hearth furnaces
Slabbing and hot strip mills
Cold-rolling mills
Annealing plant
Electrolytic tinning plant
Power plant
Water treatment plant
Waste disposal plant
Levittown
and lunch at Starkey Farms.

9:00 a.m. Leave Statler at 32nd Street door.

5:00 p.m. Arrive at Statler.

CHI EPSILON

Members of Chi Epsilon, their families and guests—men, women and children—will meet for their 19th annual gathering on Friday, October 23, 1953. Dinner ($6.50 per person) will be served at the Governor Clinton Hotel, Seventh Avenue at 31st Street, New York City, beginning promptly at 7:00 p.m. Preceding the dinner (at 6:30 p.m.) Henry T. Heald, Chancellor of New York University and brother in Chi Epsilon, will be elevated to the grade of National Honor Member of the fraternity. Dr. Heald will be the speaker at the dinner.

SESSIONS OF

BOARD OF DIRECTION

The ASCE Board of Direction will be in session at the Board Room in the Engineering Societies Building at the following times:

Monday, Oct. 19—10:00 a.m. to 5:00 p.m.

Tuesday, Oct. 20—9:30 a.m. to 5:00 p.m.

Thursday, Oct. 22—2:30 p.m.

POST-CONVENTION INSPECTION TRIP TO BERMUDA

Leave New York Saturday, Oct. 24

An unusual opportunity to visit a major offshore air installation is offered in a post-convention inspection of Kindley Air Force Base, Bermuda. This tour will combine the opportunity for a brief autumn holiday with the inspection of engineered facilities. New projects at Kindley Base include a power house, seawater distillation plant, sea wall, and improved storage facilities.

In anticipation that many will wish to enjoy the holiday facilities at Bermuda while making this trip, the trip will be made by air from New York and return, with headquarters in Bermuda at the Hotel Princess. The return to New York will be on October 28, giving five full days in Bermuda. Arrangements can be made for a longer stay if desired.

The Inclusive Price

Cost of the entire tour, including transportation and hotel with meals, is $185.10.

Reservations

Reservations must be made early. Full information pamphlets are available on request from:

Leon V. Arnold
36 Washington Square, W.
New York 11, N.Y.

INFORMATION AND REGISTRATION

Information and registration facilities will be maintained in the Rotunda on the Convention floor of the Hotel Statler throughout the days of the Convention. Mail and messages will be held for members at the Information Desk.

HOTEL ACCOMMODATIONS

Headquarters of the Annual Convention will be the Hotel Statler, located on Seventh Avenue between 32nd and 33rd Streets, directly opposite, and connected to the Pennsylvania Station. Special arrangements have been made to accommodate many Convention visitors at the headquarters hotel, up to capacity, in the order that reservation requests are received.

Send your reservation request early to assure space at the headquarters hotel. For your convenience a special request form is provided on page 107 of this issue. Late requests may have to be assigned to other nearby hotels.

ENTERTAINMENT FOR THE LADIES

Ladies' Tour of UN

Tuesday, Oct. 20

The ladies' tour of the United Nations Building is one of the highlights of the 1953 Convention program. The group will meet at the UN Building at 11:00 a.m. to begin a guided tour of one of the most famous structures in the world. Luncheon will be served at the fashionable Beekman Tower Hotel. The afternoon features of the trip will include attendance at a United Nations session.

Because of the easy accessibility of the UN Building, no group transportation will be provided. Per person $4.00.

Luncheon—Fashion Show

Thursday, Oct. 22

12:30 p.m. **Penn Top South**

Special treats will be prepared by the Statler chefs for this affair, to take place at Penn Top South.

A fashion show of wearable styles will be modeled by ASCE wives, and produced by stylists of *McCall's Magazine*.

Per plate, $3.00.

Greenwich Village Tour

Thursday, Oct. 22

8:00 p.m. to Midnight

Conducted tour of interesting spots in lower Manhattan will visit famous Greenwich Village with its art center and handicraft shops. The trip will also include Chinatown, Manhattan Night Court, and the Washington Market.

Price per person of $3.50 includes transportation from and to the Statler.

Friday Trip for the Ladies

For those who decide against the trip to the Fairless Works, the ladies committee will conduct a group through the Lighthouse for the Blind on Friday morning. Those who wish to make this visit should gather at the Ladies Headquarters in Parlor A at 10:00 a.m.

No charge for this tour.

LADIES HOSPITALITY ROOM

Parlor A **Convention Floor**

The Hospitality Room will be the gathering place of all ladies attending the Convention. It will be open from 9:00 to 5:00 on each Convention day, Monday through Friday. Hostesses will be in attendance to arrange tours, special events of interest and to answer questions about facilities of the Convention and the City of New York.

ANNUAL CONVENTION COMMITTEES

Raymond L. Brandes, *General Chairman*
Jewell M. Garrelts, *Vice Chairman*
William S. LaLonde, Jr., *Past Chairman*

Dinner Dance
John R. Zehner, *Chairman*
Richard Hazen Barclay G. Johnson

Division Luncheon
Richard H. Tatlow, III, *Chairman*
Robert H. Dodds Clinton W. Wixom

Excursions
Roger H. Gilman, *Chairman*
Emil A. Verpillot Thomas J. Fratar

Ladies Entertainment
Walter S. Douglas, *Chairman*
Richard Hazen Thomas J. Fratar

Ladies Committee
Mrs. Raymond L. Brandes, *Chairman*
Mrs. Jewell M. Garrelts, *Vice Chairman*
Mrs. William S. LaLonde, Jr., *Past Chairman*
Mrs. Walter D. Binger
Mrs. George D. Burpee
Mrs. Wm. N. Carey
Mrs. Walter S. Douglas
Mrs. Thomas J. Fratar
Mrs. Richard Hazen
Mrs. Barclay G. Johnson
Mrs. Charles B. Molineaux
Mrs. John F. Molloy
Mrs. Carlton S. Proctor
Mrs. Don P. Reynolds
Mrs. Kirby Smith
Mrs. Samuel D. Stickle
Mrs. Richard H. Tatlow, III
Mrs. Emil A. Verpillot
Mrs. Edward Wininger
Mrs. Clinton W. Wixom
Mrs. John R. Zehner
Mrs. Charles E. Trout

Membership Luncheon
Edward Wininger, *Chairman*
Richard H. Tatlow, III
Barclay G. Johnson

Publicity
Jewell M. Garrelts, *Chairman*
John R. Zehner Robert H. Dodds

Smoker
Samuel D. Stickle, *Chairman*
Emil A. Verpillot Clinton W. Wixom

Student Activities
Robert H. Dodds, *Chairman*
William S. LaLonde, Jr.

Transportation Theater
Roger H. Gilman, *Chairman*
Robert H. Dodds John R. Zehner

Convention Coordinator
Don P. Reynolds

Radio City, New York

SOCIETY NEWS

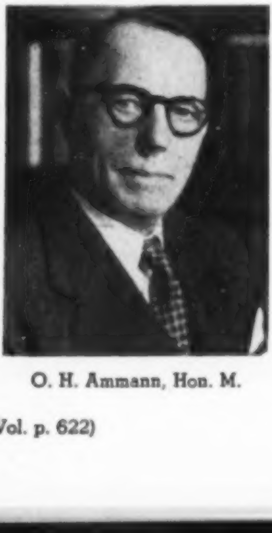
Induction of Four Honorary Members Will Be Annual Convention Feature

Several fields of engineering are importantly represented on the list of new honorary members of ASCE, elected by the Board of Direction at its recent Miami Beach meeting (July issue, page 66). Those receiving this new recognition of their contributions to the profession are Othmar H. Ammann, of New York; Arthur E. Morgan, of Yellow Springs, Ohio; John C. Page, of Denver; and Charles M. Spofford, of Boston. Presentation of the honorary memberships will be one of the features of the Wednesday morning (October 21) meeting during the forthcoming Annual Convention in New York.

Highlights in the careers of the four new honorary members follow.

O. H. Ammann

No study of the history of long-span bridge engineering progresses far before the name of O. H. Ammann comes to the fore. The George Washington Bridge, the Bronx-Whitestone Bridge, the new Delaware River Bridge at Philadelphia as well as the Golden Gate Bridge, on which he was a member of the board of consultants, are only a few of the monumental structures that stand as a tribute to his engineering skill and artistry. Few vehicles travel far in the Port of New York area without traversing one or more of O. H. Ammann's structures.



O. H. Ammann, Hon. M.

Born in Switzerland in 1879, Mr. Ammann graduated from the Swiss Federal Polytechnic Institute in 1902. During his early career he served as principal assistant engineer to C. C. Schneider & F. C. Kunz, Philadelphia consultants, and Gustav Lindenthal, chief engineer of the New York Connecting Railroad and North River Bridge Co. From 1925 to 1930, as chief engineer of bridges for the Port of New York Authority, he was in general charge of the planning and construction of the Outerbridge Crossing at Perth Amboy, N.J., over the Arthur Kill; the Bayonne Bridge, the world's longest steel arch, over the Kill Van Kull, as well as the George Washington Bridge. From 1930 to 1937 Mr. Ammann served as chief engineer of the Port of New York Authority, and in 1937 became its director of engineering. From 1934 to 1939 he also served as chief engineer of the Triborough Bridge Authority. Since 1939 he has been in private practice, and since 1946 has been the senior partner in the New York firm of Ammann & Whitney.

A number of Mr. Ammann's bridges won American Institute of Steel Construction prizes for beautiful steel bridges. Among these were the Bayonne Bridge (1931) and the Triboro Bridge (1936), both Class A winners; the low-level Hellgate Bridge in 1937; the Bronx-Whitestone Bridge in 1939; and the Harlem River Pedestrian Lift Bridge in 1952.

As a private consultant, Mr. Ammann has been engineer or consultant on the Delaware Memorial Bridge at Wilmington and the New Delaware River Bridge at Philadelphia. He has also been retained by the U. S. Bureau of Public Roads in connection with studies of the aerodynamic stability of suspension bridges.

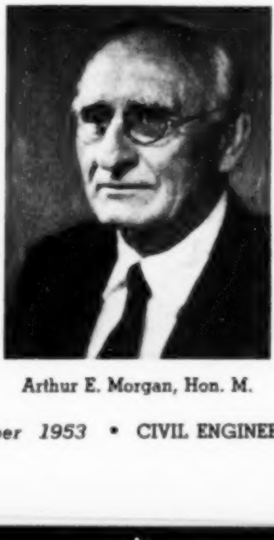
Long active in ASCE, Mr. Ammann served as a Director from 1934 to 1936 and filled many committee assignments. He was also a recipient of its Thomas Fitch Rowland Prize.

For his outstanding achievements in the field of long-span bridge engineering, he has received honorary degrees from Columbia University, Yale University, New York University, Pennsylvania Military Academy and the Swiss Federal Institute. A laudatory *New Yorker* profile on Mr. Ammann some years ago concluded, "When a bridge across the ocean is built, it will be O. H. Ammann who builds it."

Arthur E. Morgan

The control and utilization of river basins and waterways are of vital importance to the well being of America. The contributions of Arthur E. Morgan to this field will not soon be obscured. His pioneering work in the drafting of the Conservancy Act of Ohio after the disastrous 1913 flood in the Miami Valley and his work from 1933 to 1938 as chairman of the then newly formed Tennessee Valley Authority are indicative of the caliber of his engineering and organizational ability.

Mr. Morgan was born in Cincinnati, Ohio, on June 20, 1878, and his formal education was limited to about three years of high school. In 1907 he took a Civil Service examination in hydraulic engineering and received an appointment as supervising drainage engineer in the Office of Experiment Stations of the Department of Agriculture. In 1910 Mr. Morgan and Leroy L. Hidinger established the Morgan Engineering Co. in Memphis and entered private practice in reclamation of wet and overflowed lands. Individually, and through the Morgan Engineering Co., Mr. Morgan had charge of about 75 water control projects, large and small, involving reclamation of about



Arthur E. Morgan, Hon. M.

2,000,000 acres of land and the construction of some 2,000 miles of drainage canals.

After the great Midwestern flood of 1913, the Morgan Engineering Co., and later Mr. Morgan as chief engineer of the Miami Conservancy District, had charge of plans and construction of flood control works for the Miami Valley. Contracts were not let for this project, but equipment was purchased, construction staff assembled, and the $30,000,000 job was done directly by the Miami Conservancy District.

In 1920, while he was chief engineer of the Miami Conservancy District, he was made a trustee of Antioch College, an old and broken-down institution which was about to die. He proposed a reorganization of the college that was accepted by the board of trustees. Then with a reorganized board and faculty he undertook the new program, with himself as president, from 1920 to 1936. The campus has increased from 20 acres to 1,000, the budget from $15,000 to $1,500,000, and the student body from 35 to 1,000. As a research center, Antioch has a research plant of about $1,500,000 a research staff of 50 or more, and a substantial budget in addition to that of the college. The Antioch program of education is widely recognized. While at Antioch he served as Vice-President of ASCE, vice-president of the American Unitarian Association, and as the first president of the Progressive Education Association.

In 1933 Mr. Morgan was asked by President Roosevelt to become chairman of the Tennessee Valley Authority, which position he held until 1938. In addition to acting as chairman, he was directly responsible for general administration, for the construction of dams, locks and power plants, and for labor relations. Following the methods used in the Miami Conservancy District, the TVA, instead of letting contracts, built its dams and power plants with its own forces. In 1938, over a dispute in which Mr. Morgan critized the accuracy of reporting on costs of electric power, he was dismissed by the President "for contumacy."

In 1940 Mr. Morgan organized Community Service, Inc., at Yellow Springs to give expression to his conviction that the country has a vital stake in its smaller communities of which it is largely unaware. Since 1940 his major efforts have been in that field. In 1947 he went to Finland for the American Friends Service Committee to aid in developing small industries there. In 1948 and 1949 he spent nearly a year in India, as a member of a "Universities Commission" for the Indian government. He drafted proposals for a series of "rural universities." These proposals were accepted, and three or four universities along the lines of these proposals are now being developed.

John C. Page

In the service of the U. S. Bureau of Reclamation for virtually his entire career, John C. Page worked his way up from topographer to Commissioner of Reclamation. He literally grew up with the Bureau until at the time of his tenure as Commissioner, the Bureau had under construction projects of unprecedented proportions—the Columbia Basin, Central Valley, and the Colorado-Big Thompson.

Mr. Page was born at Syracuse, Nebr., on October 12, 1887. He received the degree of bachelor of science in civil engineering from the University of Nebraska in 1908, and then continued the study of hydraulics for some time at Cornell University.

Entering the employ of the Reclamation Service (now the Bureau of Reclamation), in October 1909, Mr. Page did early engineering work on the Grand Valley reclamation project near Grand Junction, where he worked as assistant engineer and assistant superintendent in charge of operation under Sinclair O. Harper, later chief engineer of the Bureau. When Mr. Harper went to Denver as the Bureau's chief of construction in 1925, Mr. Page succeeded him as superintendent of the Grand Valley project. Five years later he was transferred to the Boulder Canyon project as office engineer, serving as chief administrative assistant to Walker R. Young, construction engineer. In this position he was largely responsible for the correctness and accuracy of the myriad details of Hoover Dam and power plant.

In 1935 Dr. Elwood Mead, Commissioner of Reclamation, called Mr. Page to Washington to head the Bureau's Engineering Division. Here he made such a record of performance that a year later, on Dr. Mead's death, the President appointed him Commissioner of the Bureau. During his tenure as Commissioner, the Bureau had under construction the three huge projects previously mentioned, and was also carrying on design and construction of Shasta and Friant dams in California; Grand Coulee Dam in Washington; Anderson Ranch Dam in Idaho; Imperial and Parker dams on the Colorado River; Bartlett Dam in Arizona; Seminoe and Alcova dams in Wyoming; Alamogordo and Caballo dams in New Mexico; and Marshall Ford Dam in Texas. The basic studies, which resulted in development of the comprehensive Missouri River Basin project, were also conducted in this period, the All-American Canal was built, and construction of the Coachella Canal was initiated. His responsibility embraced the planning and development of irrigation power projects throughout the West. In total, he has been responsible for supervision of 60 reclamation and irrigation projects, 165 dams, and 28 power plants in the Western states.

When Mr. Page's health failed him, in 1943, he resigned the commissionership, but remained active as full-time Bureau consultant until 1947. In 1950 he received the Department of the Interior's highest honor, the Distinguished Service Award, and was cited for "36 years of service on the Grand Valley and Boulder Canyon projects."

Mr. Page was a member of the President's Great Plains Drought Committee in the middle thirties, and among other responsibilities served as a member of the Water Resources Committee of the National Resources Planning Board. In 1941 his alma mater, the University of Nebraska, conferred the honorary degree of doctor of engineering on him. Long active in ASCE, he served a term as president of the District of Columbia Section during his residence in Washington. He was Director from 1925 to 1927.

Charles M. Spofford

Combining a long career as engineering educator with a consulting practice, Charles M. Spofford is nationally eminent in both. Born at Georgetown, Mass., on September 28, 1871, Professor Spofford

John C. Page, Hon. M.

Charles M. Spofford, Hon. M.

received his B.S. degree from Massachusetts Institute of Technology in 1893, and was a postgraduate student in civil engineering in 1893 and 1984. From 1896 to 1905 he was at his alma mater, successively as assistant, instructor, and assistant professor of civil engineering. From 1905 to 1909 he was professor of civil engineering at the Polytechnic Institute of Brooklyn, returning to M.I.T. in the latter year as Hayward Professor of Civil Engineering, in which position he remained until 1940. He was head of the department during most of this period and chairman of the faculty for two years. Since 1940 he has been Hayward Professor of Civil Engineering Emeritus, and he has been a member of the consulting firm of Fay, Spofford and Thorndike, of Boston, Mass., since its organization in 1914.

Professor Spofford has been identified with numerous important engineering projects. He has served as expert engineer on the investigation of strength of the Blackwell's Island Bridge; as a member of the Boston Terminal Commission, and of the Advisory Committee on Charles River Bridges for the Metropolitan District Commission of Massachusetts; as advisory engineer for the Boston Branch of the Reconstruction Finance Corporation; and as consulting bridge engineer for the Tennessee Valley Authority (1934 and 1935).

The engineering practice of his firm has included the Boston Army Supply Base (a $25,000,000 war project); the Lake Champlain Bridge and Rouses Point Bridge between New York and Vermont; the Sagamore Bridge and the Bourne High Level Bridge, across Cape Cod Canal, at Bourne, Mass.; port developments in the United States and New Zealand; and the design of shipways for the Bethelehem Shipbuilding Corp. at Fore River, Mass. At present his firm is the engineering member of Architect-Engineers for Newfoundland Army Bases, and a member of Dry Dock Engineers engaged in designing eight dry docks and numerous other structures for the U. S. Navy. The Bourne High Level Bridge received the A.I.S.C. award for the most beautiful steel bridge in its class built in 1934.

Professor Spofford served as ASCE Director from 1925 to 1927 and received the second Phebe Hobson Fowler Award in 1930. He has been chairman of the Waterways Division and of the Alfred Noble Prize Committee and of the Society's Committee on the Tacoma Bridge Failure. Since 1940 he has also been a member of the Herbert Hoover Medal Award Committee. He is author of *Notes Upon the Theory of Structures* (1907), *The Theory of Structures* (1911), and *Theory of Continuous Structures and Arches* (1937).

ASCE Prizes to Be Awarded at Convention

Winners of ASCE prizes and awards for papers appearing in Volume 117 of TRANSACTIONS (1952) were announced by the Board of Direction at its Miami Beach meeting. Presentation will be a feature of the Wednesday morning business meeting (October 21) during the Society's Annual Convention. Descriptions of the various awards are given in the Official Register for 1953, beginning on page 106. Highlights in the careers of those receiving prizes and medals follow.

Friedrich Bleich and L. W. Teller

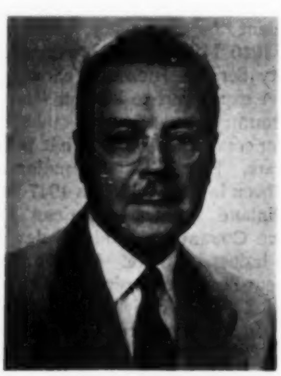
Noted as a structural engineer, author and research worker, Friedrich Bleich, M. ASCE, is for the second time a posthumous winner of the Norman Medal. The current award is made to him and L. W. Teller for their co-authorship of a paper on "Structural Damping in Suspension Bridges." Born in Vienna and educated at the Austrian Technical University, Mr. Bleich was engaged in the design of bridges, large industrial plants, and other structures there and in Switzerland before coming to the United States in 1941. From 1944 to 1947 he did research on the causes of the Tacoma Narrows Bridge disaster for the Advisory Board on Investigation of Suspension Bridges, and his previous prize-winning paper was based on this research. From 1947 until his death Mr. Bleich was associated with the New York consulting firm of Frankland & Lienhard. He also did a survey on the buckling strength of metal structures for the U. S. Navy, the results of which have since been published in book form under the title, *Buckling Strength of Metal Structures*, by the McGraw Hill Book Co.

With the U. S. Bureau of Public Roads for more than 30 years, L. W. Teller, M. ASCE, has been engaged continuously in research work in the fields of motor truck impact, structural behavior of pavements, physical characteristics of concrete and numerous special problems relating to highway bridges. For most of that period he has been in responsible charge of the structural research of the Physical Research Branch. He is author and co-author of many published papers on structural testing, instrumentation and other subjects in the fields referred to, and holds degrees in civil engineering from George Washington University (1922 and 1932).

Paul Rogers

The recipient of this year's J. James R. Croes Medal is Paul Rogers, A.M. ASCE, partner in the Chicago consulting firm of Rogers & Snitoff, Inc., who wrote on the "Design of Large Coal Bunkers." Mr. Rogers was born in the Transsylvania province of Hungary, and graduated as a civil engineer in 1934 in Paris. Coming to the United States in 1939, he attended the Graduate School of the Illinois Institute of Technology, and in 1941 joined the Pioneer Engineering and Service Corp., for which he designed power stations. He became a citizen in 1945. From 1942 to 1944 he was in charge of structural design for A. J. Boynton & Co., and worked on such projects as the Geneva Steel Plant in Utah and the Fontana Steel Plant in California. Subsequently he worked on a major expansion project for Hiram Walker & Sons Distillery; worked on mining structures for the Roberts & Schaefer Co.; designed the major portion of the O'Hara International Airport for Ralph H. Burke; and spent five years in

FRIEDRICH BLEICH



L. W. TELLER

Winners of the Norman Medal

PAUL ROGERS
J. James R. Croes Medal

E. MONTFORD FUCIK
Thomas Fitch Rowland Prize

HAROLD N. FISK
James Laurie Prize

LOUIS A. NEES
Arthur M. Wellington Prize

the employ of Sargent & Lundy, where he did considerable structural research in connection with power stations.

Since 1951 Mr. Rogers has been a part-time lecturer at the Illinois Institute of Technology. In 1950 he won the Western Society of Engineers' cash award for his paper, "The Structural Aspects of Power Plant Design." He has published numerous papers and is the author of a recently published book, *Tables and Formulas for Fixed-End Moments.*

E. Montford Fucik

The Thomas Fitch Rowland Prize for this year has been awarded to E. Montford Fucik, A.M. ASCE, vice-president of the Harza Engineering Co., Chicago, for his paper entitled "Petenwell Hydroelectric Project." A civil engineering graduate of Princeton University in 1935, where he was elected to Phi Beta Kappa, Mr. Fucik was awarded a master of science in engineering degree by Harvard University in 1937. Going to the Harza Engineering Co., in 1938 as foundation engineer, he supervised the foundation investigations, design, and construction of some 15,000,000 cu yd of earth dams for the Santee-Cooper hydroelectric project in South Carolina. From 1940 to 1942 he was in charge of foundation investigation and design for the Third Locks project of the Panama Canal, and from 1943 to 1945 an officer in the Civil Engineer Corps of the Navy.

From 1945 to the present Mr. Fucik has served, first, as an associate and, since 1950, as vice-president of the Harza Engineering Co., consulting engineers specializing in the hydroelectric field. The practice of the firm is world-wide. Mr. Fucik is vice-president of the Illinois Section of ASCE and chairman of the General Education Committee of the Technical Societies of Chicago.

Harold N. Fisk

Harold N. Fisk, who is awarded the James Laurie Prize for a paper on "Mississippi River Valley Geology Relation to River Regime," has been chief of the Geologic Research Section, Humble Oil & Refining Co., Houston, Tex., since 1948. Before that he taught geology courses at Louisiana State University, starting as instructor in 1935 and becoming full professor in 1946. In addition, from 1935–1940 he was a research geologist for the Louisiana Geological Survey and published reports on the geology of several parishes (counties) in bulletins of the Survey. As a result of this work he developed a keen interest in problems of alluvial geology and has devoted considerable time to interpreting stream behavior in alluvial regions.

Since 1941 Mr. Fisk has served as consultant to the Mississippi River Commission, directing geological investigations in the lower Mississippi Valley. From 1950 to 1952 he directed work for the Commission on geological aspects of a study designed to determine the feasibility of diverting the Mississippi River down the Atchafalaya River. The results of this study were published in 1952 as "Geological Investigation of the Atchafalaya Basin and the Problem of Mississippi River Diversion." Mr. Fisk is a graduate in geology of the University of Oregon (B. S. 1930, M. A. 1931), and of the University of Cincinnati (Ph. D. 1935).

Louis A. Nees

Recipient of the Arthur M. Wellington Prize is Louis A. Nees, A.M. ASCE, who wrote on "Pile Foundations for Large

KUANG-HAN-CHU
Collingwood Prize for Juniors

ARTHUR T. IPPEN
Karl Emil Hilgard Prize

RALPH STONE

WILLIAM F. GARBER

Winners of Rudolph Hering Medal

Towers on Permafrost." A graduate of Rensselaer Polytechnic Institute in 1931 with the degree of civil engineer, Mr. Nees has been continuously employed by the U.S. Government since 1934. Before the war he was engaged in hydrologic and hydraulic design of dams, reservoir systems, and local flood-protection projects in various Corps of Engineer Districts. In 1941 he began four years of military service with the Corps of Engineers on military construction in the United States and Greenland, becoming staff engineer for the command in November 1944. During this period he first became actively concerned with design and construction on permafrost.

For the past six years Mr. Nees has been with the Installations Division of Hq. Air Materiel Command, Dayton, Ohio. During this period he was a U.S. representative on two joint Canadian-American engineering teams that made extensive expeditions into the Canadian and American Arctic. For the past $2^1/_2$ years he has been head of the Engineering Branch of the Division, engaged primarily in the design of shops, hangars and aircraft engine test cells.

Kuang-Han Chu

The Collingwood Prize for Juniors goes to Kuang-Han Chu for a paper entitled "Truss Deflections by the Coordinate Method." Born in China, Mr. Chu graduated with a B. S. degree from the National Central University in 1942. He had experience in bridge design (with the Bureau of Highways), teaching (in the National Central Institute of Technology), and railroad location (with the Bureau of Railroad Surveying) before coming to the United States. In April 1946 he was sent to this country by the Chinese government to pursue further studies. He entered the University of Illinois, where he majored in structures, obtaining a M.S. in 1947 and a Ph.D. in February 1950. After graduation, he worked with Ammann & Whitney on New Jersey Turnpike bridges. With D. B. Steinman since September 1951, he has worked on several interesting projects, such as the proposed Kingston-Rhinecliff Bridge, the Raritan River Bridge piers, and is now engaged in designing the proposed Mackinac Straits Bridge towers.

Arthur T. Ippen

Widely known for his research and professional activities in the field of fluid mechanics, hydraulic engineering and hydraulic machinery, Arthur T. Ippen, M. ASCE, winner of the Karl Emil Hilgard Prize for a paper on "Mechanics of Supercritical Flow," is professor of hydraulics and in charge of the Hydrodynamics Laboratory at the Massachusetts Institute of Technology. Before going to the Institute, Dr. Ippen was responsible for instruction in fluid mechanics at Lehigh University, and for the complete revision of the Hydraulic Laboratory there. He was appointed associate professor of hydraulics at M.I.T. in 1945, and was advanced to the rate of full professor in 1948. Born in London, England, Dr. Ippen graduated from the Technical University of Aachen, Germany, in 1931, with the degree of Dipl. Ing. He was an exchange fellow at the University of Iowa Institute of Hydraulic Research, and from 1934 to 1937 was a teaching and research fellow in hydraulics at the California Institute of Technology. There he received the degree of master of science in 1935 and the degree of doctor of philosophy in 1936.

His research activities in the field of fluid flow and his investigations have covered a wide range of subjects, including High Velocity Flow in Open Channels, Viscous Flow Through Centrifugal Pumps, Model Studies of Spillways, Hydraulic Analogy to Supersonic Flow, Characteristics of Turbulent Streams, Wave Motion, and others. He was in charge of the planning for the new Hydrodynamics Laboratory at M.I.T., which was dedicated in 1951.

Ralph Stone and William F. Garber

Ralph Stone, A.M., ASCE, sanitary engineer for the Industrial and Government Projects Division of the Fluor Corp., Los Angeles, is co-winner with William F. Garber of the Rudolph Hering Medal for a paper, entitled "Sewage Reclamation by Spreading Basin Infiltration." Mr. Stone holds bachelor and master of science degrees from the University of California at Berkeley, 1943 and 1944. From 1944 to 1946, the U.S. Public Health Service commissioned him as a sanitary engineer assigned to the Florida State Board of Health, to perform technical liaison work between state, federal and Armed Forces agencies. Joining UNRA in 1946, he was assigned to the China Office, and later was a sanitary engineering adviser with the Nationalist Government of China through the U.N. World Health Organization. Subsequently he worked as a research engineer for the Los Angeles County Flood Control District on sewage reclamation field tests, and through the Institute of Inter-American Affairs, was assigned to the Colombia Government Ministry of Hygiene in South America carrying out Point 4 type development advisory work. From 1950 to 1952, he was on the University of California Sanitary Engineering Research Project, completing investigations on incineration refuse disposal and waste water reclamation. Mr. Stone is the author of many papers based on investigations in the sanitary field.

William F. Garber, co-winner of the Rudolph Hering Medal, is laboratory director of the Hyperion Treatment Plant of the City of Los Angeles. Graduating from the University of California at Berkeley in 1941 with a B.A. in chemistry, Mr. Garber did early work as a chemist for a Pasadena consulting firm. From November 1947 to February 1951 he was chemist in charge of the laboratory of the Los Angeles County Sanitation Districts. His investigations during the latter period included the work on sewage reclamation reported in the paper now receiving the Hering Medal. As laboratory director of the Hyperion Treatment Plant since February 1951, Mr. Garber has had general responsibility for all data used for control of plant processes, and been in charge of experimental work aimed at process improvement and cost reduction.

Data for ASCE Membership Directory Requested

The next Membership Directory will be issued early in 1954. It will carry address data of record in the Society's files as of September 30, 1953. In order that the Directory may be as complete and useful as possible, all members who have not furnished the headquarters office with up-to-date personal information are urged to do so. The information should include (1) full name, (2) name and address of organization with which associated, (3) title of position with the organization, (4) complete residence address, and (5) indication of mailing address to be used—business or residence.

Postal card requests for reporting changes of address will not be sent to members. Each one will be responsible for supplying information as to change of address or occupation. In order to meet production schedules, changes recorded later than September 30 cannot be carried in the Directory.

For the convenience of members, the coupon on page 90 of this issue may be used.

Leon S. Moisseiff Award Goes to Ten-Man Committee

This year the Leon S. Moisseiff Award goes to a ten-man committee for a paper on "Lateral Forces of Earthquake and Wind." Recipients, in addition to the eight engineers shown and identified here, are Arthur W. Anderson, of Corlett & Anderson, Oakland, Calif., and Henry L. Marchand, consulting engineer of San Francisco. Photos and biographical material are not available for them.


(1) John A. Blume


(2) H. J. Degenkolb


(3) H. B. Hammill


(4) E. M. Knapik


(5) Henry C. Powers


(6) John E. Rinne


(7) G. A. Sedgwick


(8) H. O. Sjoberg

(1) A consulting civil and structural engineer with offices in San Francisco, John A. Blume has been active in earthquake and other lateral force considerations in research, code work, design, construction, and as former chairman of the Society's Joint Committee on Seismology. He is a graduate of Stanford University.

(2) Henry J. Degenkolb is at present chief engineer for John J. Gould, San Francisco consultant. A graduate of the University of California, he has been connected with many important San Francisco projects including the buildings for the Golden Gate International Exposition.

(3) Harold B. Hammill has had his own consulting office in San Francisco since 1926, with wide practice on the structural design of buildings, bridges, cranes, and sanitary and hydraulic structures. He is a graduate of the University of California.

(4) Edward M. Knapik has been associated with Walter L. Huber, consulting civil engineer, since 1922, and since January 1941 has been a partner in the firm of Huber and Knapik. He has designed and supervised construction of many major San Francisco projects, including the Union Square underground parking garage, and shop building and other structures for the U.S. Naval Shipyard. He is a graduate of the University of California.

(5) Henry C. Powers has served on practically all local committees on earthquake codes for the past 25 years. As engineer in charge of the office of H. J. Brunnier, consulting structural engineer, he has designed many of the large buildings in San Francisco and Los Angeles.

(6) With the Standard Oil Company of California since 1937, John E. Rinne currently heads the civil engineering and architectural work for its Engineering Department. He was chairman of the ten-man committee responsible for the prize-winning paper. He holds bachelor and master degrees in civil engineering from the University of California.

(7) A graduate of the University of California, George A. Sedgwick has been structural engineer with W. P. Day, Architect-Engineer of San Francisco, since 1946. Earlier he did engineering work for the Panama Canal and the Canol Project in Canada, and from 1928 to 1940 he was with the State of California in various engineering positions.

(8) Harold O. Sjoberg has been owner of the construction firm of N. H. Sjoberg & Son since 1944. Earlier he was engaged on various phases of the design and construction of the San Francisco-Oakland Bay Bridge and other structures. As structural engineer for Austin W. Earl from 1941 to 1944, he had charge of many Navy projects. He is a graduate of the University of California.

Technical Divisions Plan Expansion at Chicago Conference

The obligation to the profession held by the Technical Divisions of ASCE was stressed by Vice-President George W. Burpee in a stimulating address to the 1953 Technical Procedure Conference held in Chicago. To meet such responsibilities, the several Divisions planned new procedures and programs to expand the output of technical information to the profession. Many more engineers will be needed for active participation in the work of the Divisions if such progress is to be possible.

Meeting at the Hotel Windemere East on August 13 and 14, nearly 50 representatives of the Divisions and related committees studied patterns of organization that would provide a solution to problems in research, design, and construction. To finance such activities, the largest budget ever proposed for Division use (over $40,000) was recommended by TPC to the Board of Direction for adoption next October. Renewed emphasis was given to the cooperation needed between the Divisions and Local Sections of the Society. This situation was the subject of a special report by J. M. Garrelts, chairman of the Committee on Study of Division Structure.

Throughout the Conference the need for new manpower in the Divisions to carry out the expanded program of activities was stressed. Numerous new committees are in process of formation, where needed activities cannot be managed by the number of persons now engaged in the time they are able to give to work of the Society. Administrative committees are being set up to plan programs, supervise publications, develop contact with Local Sections, and strengthen cooperation with other societies.

The experience of the Construction Division has proved the value of a Committee on Session Programs, Arthur E. Poole said in a report to the conference. The extent and number of sessions was greater than could be handled effectively by any other system. With additional manpower, it will be possible to attain better and more timely programs at Division sessions was the advice of Trent R. Dames. Reporting for the Committee on Study of Technical Sessions, Mr. Dames stated that much information just does not reach the profession. Better patterns of organization were urged.

To develop channels of cooperation between the Divisions and the Local Sections of the Society, the Soil Mechanics and Foundations Division has found an administrative committee very useful, reported Hamilton Gray. Continuous effort is essential to assure participation of Sections in work of the Divisions, in the interest of the many members at Local Section level.

Channels of cooperation with other societies are also important, said Harold B. Gotaas, chairman of the Sanitary Engineering Division. With so many members holding membership in several other organizations, it is imperative that competitive practices be minimized to avoid costly duplication, paid for by dues of the same group of men. As an example of successful joint operation, Dr. Gotaas cited the Joint Committee on Advancement of Sanitary Engineering, which represents five groups (page 74).

The Committee on Publications estimates that new procedures will permit output of a vast number of papers and

discussions, according to the chairman of that committee, Louis R. Howson. The Divisions have new responsibility for control of such publications, and in many cases have set in motion new machinery to administer publication. Such an organization is in operation for the Soil Mechanics and Foundations Division, reported Stanley D. Wilson, secretary of the Division. Professor Wilson said that over 100 engineers have joined in the work of the Division to review and edit papers for publication by ASCE.

All too frequently engineers are too modest to express forcefully a difference of opinion on engineering analysis, said George W. Burpee, chairman of the Conference. Citing a few most profitable sessions where frequent honest controversy between engineers permitted establishment of newly accepted principles, Mr. Burpee urged the Divisions not to discard all attention to a subject just because differences of viewpoint are involved. Especially during open sessions at ASCE Conventions, subjects can and should be open for frank discussion.

To get the most out of their membership in a Division, reported N. M. Newmark, of the Engineering Mechanics Division, men must take an active part at one point or another. This Division has been studying management of committees to permit better use of available men.

Junior Members are especially active in many assignments, said Raymond Archibald, chairman of the Structural Division, and should be given opportunity wherever possible to enter into full professional association as soon as they exhibit willingness and ability to carry out activities.

To maintain contact with the membership, news outlets must be developed said Don P. Reynolds, Assistant to the Secretary of ASCE. The vast amount of work accomplished by the Divisions too often never comes out because of inadequate news channels. More use of CIVIL ENGINEERING, the technical press, and newsletters was urged. Enthusiastic acceptance of the Hydraulics Division Newsletter was reported by Francis M. Bell, chairman of that Division. Mr. Bell's cost figures and survey data were helpful to other Divisions planning newsletters.

Elmer K. Timby presented a proposal for an extensive new research planning program to be conducted by the Divisions. Mr. Timby cited the many handicaps encountered by the profession where scientific data are lacking at the same time that duplications of research projects may exist in other cases. If a survey were to be undertaken, said Mr. Timby, such lacks and such duplications could be avoided.

The extent of information generated by the profession in some specialty areas, said Francis M. Bell, precludes the possibility of outlet through the three national Conventions of ASCE held each year. To meet the need, his Hydraulics Division has pioneered in Division-sponsored conferences apart from the conventions.

Attendance at the conference included the chairmen of the Division executive committees, the men who will become chairmen during the Annual Convention in October, members of the Division Activities Committee, Executive Secretary William N. Carey, members of task committees, and President Frank W. Edwards, of the Illinois Section, who welcomed the delegates to Chicago.

Specialty Board for Sanitary Engineers Recommended

Use of the facilities of ASCE and Engineers Joint Council to obtain desired certification of sanitary engineers has been recommended by the Joint Committee for Advancement of Sanitary Engineering, a grouping of representatives of five major organizations in the field. After detailed study of numerous proposals for enhancing the recognition of sanitary engineers, action was taken, during a meeting of the committee in Washington on July 27 and 28, recommending steps to be taken in establishment of a Specialty Board.

As proposed, a certification board of five members, recommended by the joint committee, will be appointed by the Board of Direction of ASCE. Ultimately, both the Joint Committee and the Specialty Board are expected to become administrative functions of Engineers Joint Council, because of the cooperative interest of several professional organizations in the program. Functions of the board members will be augmented by appointed consultants.

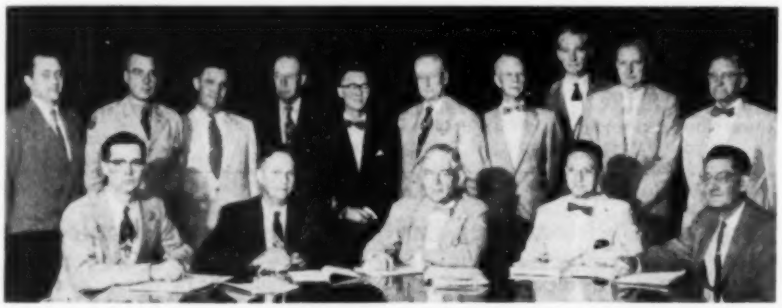
Upon application by individuals and satisfactory evidence of professional ability in the field of sanitary engineering, certificates will be issued. Those so certified will be designated members of an American Academy of Sanitary Engineers. It is not proposed that this academy become "just one more" organization to collect dues, hold meetings, issue publications or in other manner further duplicate such activities now conducted by existing organizations. The sole proposed purpose of the Academy is recognition of those certified by the specialty board. Modest expense for operation of the board, issuance of certificates, and maintenance of a roster will be defrayed by collection of a fee for certification.

Before this proposal can become a reality, endorsement of the ASCE Sanitary Engineering Division and approval by the ASCE Board of Direction are needed. Before EJC can administer the program, adoption of the proposal by that council is required.

Represented on the joint committee which produced the proposal are: The American Public Health Association, the American Society of Civil Engineers, the American Society for Engineering Education, the American Water Works Association, and the Federation of Sewage and Industrial Wastes Association.

Representatives assembled at the Washington meeting confirmed Earnest Boyce, M. ASCE, of Ann Arbor, Mich., as chairman of the Joint Committee and Alfred Wieters, M. ASCE, of Washington, D.C., as secretary.

As a definition of sanitary engineering, the joint committee adopted the statement prepared by the Committee on Sanitary Engineering of the National Research Committee in October 1943.



Attending recent Conference of Joint Committee for the Advancement of Sanitary Engineering, held in Washington, are (seated, left to right) D. F. Metzler; Rolf Eliassen; Earnest Boyce, chairman; R. E. Fuhrman; and A. H. Wieters. Standing, in same order, are D. P. Reynolds, S. J. Weidenkopf, R. E. Lawrence, W. A. Hardenbergh, J. E. Kiker, Jr., W. R. La Due, R. S. Rankin, R. E. Stiemke, C. I. Sterling, and T. R. Camp.

Designation of Man-Made Wonders Progresses

CHARLES M. BAYER, ASCE Public Relations Consultant

What are the Seven Engineering Wonders of the United States? Perhaps they are by way of being indicated, for the 36,000 members of ASCE have undertaken, on a regional basis, to designate the top achievements in their respective areas.

Thus, far, selections have been made by Local Sections in the New York metropolitan area, Washington, D.C., Cleveland, Cincinnati, St. Louis, Tacoma, Sacramento, San Francisco and Los Angeles. Significantly, bridges have topped the lists in several instances. It is noteworthy, too, that in the voting some of the most publicized projects have failed to make first rating by the engineers themselves. Though selections of such a nature are likely to be controversial, the balloting has served to stimulate professional and public interest in civil engineering's vital role in the advancement of civilization.

In the metropolitan area of New York, top honor went to the George Washington Bridge over the Hudson River, the longest suspension crossing at the time it was built. Brooklyn Bridge came in second. Runners-up included the Empire State Building, New York's subway system, its Delaware River water supply, the Holland Tunnel under the Hudson River, and the Brooklyn Battery Tunnel.

Engineers of the nation's Capital picked first, Major L'Enfant's city plan for Washington, D.C. Contenders were the Capitol dome, made of hundreds of plates bolted to 13 massive iron ribs supported by ingenious cantilever connections attached to 72 iron columns embedded in brick; the Washington Monument, the world's tallest obelisk; the Old Potomac Lock and Canal system, engineered by George Washington; the David Taylor Model Basin near Carderock, Md., for testing ship models; the terrestial magnetism laboratory at Carnegie Institution; and the remodeling of the White House.

Cleveland's highest score went to the Terminal Tower group of six buildings, involving an intricate development which brings railroads to Public Square and provides a far-sighted plan for the future. Other projects that received many votes were the Cleveland Municipal Stadium; Main Avenue Bridge over the Cuyahoga River; the shoreway and freeway system; the municipal water system; metropolitan parks encircling Greater Cleveland; and the Cleveland Museum of Art.

Cincinnati's civil engineers regard the suspension bridge, over the Ohio River, completed in 1866 under Colonel Roebling's direction, as worthy of first place. Still in effective service, it is said to have been the first connecting link between the North and South after the Civil War. Others in the running were the Ingalls Building; the Cincinnati water works; the Cincinnati Southern Railway; canalization of the Ohio River; Mill Creek Barrier Dam; and the Walter C. Beckjord steam power plant at New Richmond.

St. Louis civil engineers gave the blue ribbon to the time-honored Eads Bridge across the Mississippi. Completed in 1874 by James B. Eads, the project involved use of pneumatic caissons for the first time in the United States in sinking piers and the east abutment. It also made the first extensive use of steel and alloy-steel in bridge construction in the United States. Contenders among the "wonders" voted on were the Union Station, the Chain-of-Rocks Filtration Plant, the River Des Peres Drainage Canal, the Chain-of-Rocks Locks, the Anheuser-Busch Brewery, and the Meramec Power Plant of the Union Electric Co.

Among the engineering wonders of the Northwest those regarded by the Tacoma Section as most notable are Grand Coulee Dam, which was accorded first place; the Tacoma Narrows Bridge; the Lake Washington floating concrete-pontoon bridge; the Great Northern Railway's Cascade Tunnel; McNary Lock and Dam; Bonneville Lock and Dam; and Chief Joseph Dam. The four dams are on the Columbia River.

In this order of selection, the Sacramento Section found the outstanding accomplishments in its area to be the Trans-Sierra-Nevada Railroad location for the Central Pacific Railroad; Shasta Dam; long-distance power transmission, Folsom to Sacramento, in 1895; the Pelton Water Wheel; the 1,720-ft head inverted siphon on the water supply pipe line for Virginia City, Nev.; Sacramento–San Joaquin river delta reclamation; and the hydraulic giant for placer mining.

In the San Francisco Bay region, civil engineers had no difficulty in giving top honor to the world's longest suspension bridge, the Golden Gate Bridge. Others receiving major totals were the San Francisco–Oakland Bay Bridge, including twin suspension structures, a tunnel and a cantilever bridge; Union Square Garage, a four-story underground structure; the world's largest crane at the Hunters Point Naval Shipyard; the Moffett Field wind tunnels; Treasure Island, which involved a dredged fill of 20,000,000 cu yd; and the Oakland–Alameda Tube under the Oakland Estuary.

In appraising engineering achievements in Southern California and contiguous territory, including part of Nevada, the Los Angeles Section voted first place to the Colorado River Aqueduct of the Metropolitan Water District of Southern California, said to be the longest and largest domestic water supply system in the United States. Other projects receiving large totals were the Hyperion Sewage Treatment Plant and the Los Angeles Municipal sewage collection system; the Kaiser steel plant at Fontana; the Pershing Square underground garage; Hoover Dam and power plant; Los Angeles–Long Beach harbor development; and the Los Angeles County flood control system.

When Sir Oliver Franks, in a recent farewell broadcast to the American people just before his retirement as ambassador to the United States, undertook to appraise the "man-made wonders" that he had observed in this country, he listed: "The San Francisco Bay bridges; the Chicago River, where man reversed the flow of the stream so that a ship can sail from the Great Lakes down the Mississippi and into the Gulf of Mexico; Grand Coulee Dam, symbol of how you have harnessed your mighty surging waterpower; the New Jersey Turnpike; the New York City skyline; Los Alamos, a city of 15,000 built in a couple of years out of the emptiness of the desert in the service of atomic power; and I wonder if you would include as the seventh in your list the largest office building in the world, the Pentagon, that immense monument to man's servitude to the desk, he concluded."

The "Seven Wonders of ancient times were the Pyramids of Egypt, the Hanging Gardens of Babylon, Phidias' Statue of Zeus, Temple at Ephesus, the tomb of Mausolus, the Colossus of Rhodes, and the Pharos lighthouse at Alexandria. Only the Pyramids survive. The Great Pyramid, containing 3,000,000 cu yd of masonry, the biggest individual block in the world prior to Grand Coulee Dam, required some 100,000 laborers for 20 years. Built about 2700 B. C., long before mechanization, the job involved a labor cost of about 400 man-hours per cu yd.

The Great Wall of China, containing some 300,000,000 cu yd and built more than a century before Christ, still is the world's greatest connected masonry structure. Its labor cost was something like 150 man-hours per cu yd. The labor cost of the 10,500,000 cu yd of concrete construction on Grand Coulee Dam, was perhaps, 3 man-hours per cu yd.

Many of the Sections still have their choices ahead of them, so that it will be a considerable time before final designation of the top seven wonders in the nation can be made.

Past-President Howard Dies Suddenly

Members of the Society will be grieved to hear of the sudden death of Past-President Ernest E. Howard, who was stricken in his office in Kansas City, Mo., on August 19. Mr. Howard, who was 72, was senior partner in the New York and Kansas City consulting firm of Howard, Needles, Tammen & Bergendoff, which specializes in bridge design. A graduate of the University of Texas in 1900, Mr. Howard had been in private practice since 1901—for most of the period as a partner in Howard, Needles, Tammen & Bergendoff and its predecessor organizations. His firm's recent projects included the New Jersey Turnpike and the Delaware Memorial Bridge at Wilmington. Mr. Howard himself was consultant to the Commission on Renovation of the White House.

Ernest E. Howard

Joining the Society in 1905, Mr. Howard was Director from 1941 to 1943 and Vice-President in 1945 and 1946. As President in 1950, he set a new record for travel to Local Section and Student Chapter meetings and for participation in Society activities.

New Student Chapter Handbook Available

For ready reference on matters of Student Chapter organization and operation, the Committee on Student Chapters has made available a new edition of its *Handbook for ASCE Student Chapters.* Need for this 1953 edition (the sixth issued since 1935) results from recent changes in the Society's Constitution and Bylaws as well as from normal changes in ASCE operating procedures. There has also been extensive rewriting and rearrangement of material in the interest of readability and accuracy.

Copies of the new Student Chapter source-book have already been mailed to Faculty Advisers, Contact Members, Junior Contact Members, and Student Chapter secretaries. Free copies are available to any other member upon application to the Executive Secretary at ASCE headquarters. The last revision of the handbook was prepared in 1941.

Questionnaire on Employment Conditions Mailed to Members

Since 1937 ASCE has taken an active interest in the status of engineer employees under the national labor laws. It consistently opposed the old "Wagner Act" as it affected engineers. In fact the Society took the lead in having included in the Taft-Hartley Act the provisions that give to professional employees freedom to join or not to join collective bargaining groups.

Recent activities of certain labor unions and other collective bargaining developments are giving concern to the ASCE Committee on Employment Conditions and to the Board of Direction, because of a feeling that these developments, if unchecked, may affect seriously all engineers, employees, and employers alike. Members in some areas of the country are more immediately concerned than in others, but the problems posed are of major long-range concern to the Society and to the whole profession.

To determine the views of members, their own conditions of employment, and the extent and type of collective bargaining engaged in by members, the Board of Direction has directed the preparation and mailing to members of a simply-answered questionnaire. These questionnaires were mailed early in August. The information to be gained from the questionnaires is important. An answer, which can be mailed to Society Headquarters in the accompanying addressed business reply envelope, is needed from every member.

In view of the significance of the survey, it is earnestly hoped that a large return will be received. Members who have not already returned their questionnaire should do so at once.

Ira A. Hunt, Jr., Is New Freeman Fellow

The winner of this year's Freeman Fellowship has been announced by the Award Committee as Ira A. Hunt, Jr., J. M. ASCE, captain, Corps of Engineers, U. S. Army. Captain Hunt attended Vanderbilt University for two years. He received his bachelor of science degree from the U.S. Military Academy at West Point, from which he graduated in 1945 as a distinguished cadet. He then served three-and-a-half years in Europe in various construction and troop assignments.

Ira A. Hunt, Jr.

Returning to this country in 1949, Captain Hunt attended Massachusetts Institute of Technology where he received his master of science degree in 1950. He was an instructor in thermodynamics and fluid mechanics at the U. S. Military Academy, and in 1952 was the exchange instructor from West Point to the U. S. Naval Academy at Annapolis.

Captain Hunt left August 25th for Europe, where he will carry on a program of study and research. His first stop will be a 40-day stay in Holland, where he will make a report on the recent storm damage to dikes and levees. He has particular interest in waves and wind tides, wind velocity profiles, and wave run-up on protective works. He will spend the greater part of his time at Grenoble, France, where he will take a course at the University of Grenoble, and do laboratory research at the famous Neypric Hydraulics Laboratory. He expects to visit most of the large European universities to make a survey of the methods of instruction and the laboratory equipment and procedures used in their hydraulic courses.

The Freeman Fund was established in 1924 by the late John R. Freeman, Past-President and Honorary Member of the Society.

FROM THE NATION'S CAPITAL

JOSEPH H. EHLERS, M. ASCE
Field Representative ASCE

Legislation

Congress adjourned on August 3, and will reconvene on January 6, 1954, unless called into special session by the President before that date. The number of bills passed was not large. They deal with major problems of the economy, including international affairs, government reorganization, and necessary appropriations.

A measure of particular interest to engineers was the action to abolish the income-tax exemption on earnings outside the United States of persons absent for 17 out of 18 consecutive months. The law was passed primarily to prevent movie stars gaining exemption on large sums earned abroad. The Senate added a provision allowing an exemption of $20,000 which was adopted in the law as finally passed. The Society made representations to the Senate and the House in support of this $20,000 exemption, stating "We feel that the amendment permitting an exemption of $20,000 would afford substantial relief to many engineers and other technical workers engaged on essential foreign projects without in the least nullifying the principal objective of the House bill of closing a tax loophole."

Appropriations were cut below those recommended by the President for many departments. Foreign aid was also cut. Air-force base construction was pared considerably and Civil Defense funds were seriously slashed.

Certain bills of particular interest to engineers are still pending and will be considered when Congress reconvenes. No final action was taken on H.R. 1839, the bill designed to give contractors the right to judicial review in disputes on Government contracts. The companion bill, S. 24, passed the Senate but, as was the case last year, got caught in the closing rush of the House.

H.R. 10, cited as "Individual Retirement Act of 1953," deals with retirement plans for self-employed professional men and others not presently included in pension plans. It would permit excluding from the individual income tax base a portion of the income paid to a restricted retirement fund or as premiums under a restricted retirement annuity contract. This measure received no consideration until after adjournment. Hearings were held August 12th before the House Committee. The Field Representative appeared to submit a brief in support of the legislation, on behalf of the President of Engineers Joint Council.

The following quotations are from the EJC brief.

"We are convinced that the present system of income taxation imposes manifest inequity on 'earned income' such as that derived from salaries, professional fees and other forms of compensation for professional services. . ."

"The advantage to employees who participate in private plans is obvious. The employer places aside funds which are not taxable to the employee currently, and no tax is required until the employee receives the benefit upon retirement. We believe it only fair that self-employed persons be granted some comparable opportunity to provide for retirement income. . ."

"It is very difficult for an engineer, architect, lawyer, doctor or any other person whose income is derived from personal services, to set aside, during his years of relatively high earning capacity, enough to provide adequate income for his declining years, to say nothing of providing for his family after his death."

". . . The situation of the individual practitioner is further aggravated by fluctuations in yearly income. It is just about inevitable that, while the income of such a person may be substantial during some one year, or brief period of years, it will suffer drastic decline in others. In case of illness his income may cease entirely. The result, of course, is that the individual practitioner, in the long run, is required to pay income taxes reaching a high total as compared to his total income throughout a period of years."

The American Bar Association and the American Medical Association also appeared in support of the measure. It is hoped that the Ways and Means Committee will be persuaded to incorporate the provisions of this bill in its tax revision program.

Another bill remaining for later consideration is H.R. 4393, which would permit a deduction as business expenses of certain educational expenses incurred by professional people.

The bill to amend and extend the Renegotiation Act of 1951 failed of passage. A Senate amendment was offered to raise the minimum profit for renegotiation from $250,000 to $500,000. Although the Act expires at the end of this year, it is likely that an extension will be passed in the next session retroactive to the beginning of 1954.

Government Reorganization Continues

Considerable advances were made in government reorganization. Ten reorganization plans submitted by the President are now in effect. The plans establishing the Department of Health, Education and Welfare, reorganizing the Department of Agriculture, the Defense Department and the Office of Defense Mobilization have been mentioned in this column in recent months. A Foreign Operations Administration has been established for the purpose of consolidating activities of the Mutual Security Agency and the so-called Point IV Program.

Further major reorganizations will be studied. P. L. 3 extends until 1955 the President's power to propose reorganization plans. P. L. 108 sets up a Commission on Governmental Operations which will be headed by former President Herbert Hoover, Hon. M. ASCE. It is empowered to make recommendations for changes in basic laws relating to federal activities. S. C. Hollister, M. ASCE, dean of the Cornell University College of Engineering and prominent in ASCE committee activities, has been named as a member of this most important twelve-man Commission.

P. L. 109 establishes a Commission on Inter-Governmental relations. This commission will study the duplications now existing between operations of the federal and state governments and may make far-reaching recommendations for a transfer of some federal functions to the states. The relation of the Federal Aid Highway programs to the states will be carefully considered.

Some reorganization activities of a less formal nature are taking place. Two Deputy Chiefs of Engineers are being named in place of one. Maj. Gen. B. L. Robinson, M. ASCE, will supervise both military and civil construction and related activities. The other Deputy Chief, Brig. Gen. A. C. Lieber, M. ASCE, will supervise military operations, operational planning and other activities. Certain work done by the Bureau of Standards for the Department of Defense will be taken over directly by the Department of Defense.

A three-man team is studying the organization involved in carrying out the Mutual Security program and will attempt some streamlining operations in the Washington offices.

The Board of Directors of the Export-Import Bank has been abolished under Reorganization Plan No. 5. Maj. Gen. Glen E. Edgerton, M. ASCE, now heads the Bank in the capacity of managing director.

Controls Revoked

The last of the Controlled Materials Plan regulations were revoked, and a simple priority system for scarce metals for direct defense and atomic energy programs is in effect. Allotments for direct orders ("A" products) amount to 4,000,000 tons of steel, 460,000,000 lb of copper and alloys and 430,000,000 lb of aluminum for the second half of 1953. Federal rent controls are fast disappearing even in such defense areas as Norfolk, Va. A few, such as Fairbanks, Alaska, will remain under controls.

Thus we progress toward the new economic and governmental pattern decreed by the people last year.

Washington, D.C.
August 15, 1953

ASCE MEMBERSHIP AS OF AUGUST 10, 1953

Members	8,413
Associate Members	10,749
Junior Members	17,201
Affiliates	69
Honorary Members	40
Total	36,470
(August 8, 1952	35,112)

NOTES FROM THE LOCAL SECTIONS

(Copy for these columns must be received by the tenth of the month preceding date of publication.)

Montana Section Officers Visit Canyon Ferry Dam

Canyon Ferry Dam, on which construction started in May 1949, probably will be completed and in operation before the end of 1953, according to W. N. Carey, Executive Secretary of ASCE, who made an inspection trip over the project in connection with a Helena meeting of the Montana Section, July 20. A U.S. Bureau of Reclamation project, Canyon Ferry Dam is part of the Missouri River Basin project authorized by Congress in 1944. It is located about 15 miles east of Helena.

The dam is a multiple-purpose, irrigation and power job of the concrete-gravity type, 225 ft high, and 1,000 ft long, and has a volume of 420,000 cu yd of concrete. The reservoir capacity is 2,043,000 acre-feet. The power plant will have a rated capacity of 50,000 kw from three generators, and will have an estimated annual production of 285,000,000 kwhr. River outlet capacity is 9,500 cfs. The spillway, which has a capacity of 150,000 cfs, is located at the center section of the dam and is controlled by four radial gates, each $34^1/_2$ ft × 51 ft.

In producing the 420,000 cu yd of concrete required, the Reclamation Bureau asserts that a saving of about $625,000 was made through use of fly ash as an admixture and substitute for 25 percent of the portland cement.

During the early stage of construction of the dam, the Missouri River was diverted around the cofferdams through an 18- by 65-ft timber and steel flume 1,000 ft long. After the concrete had risen above high water the river was diverted through the dam over a low block.

The prime contract for the dam and powerhouse building, let in April 1949 to Canyon Constructors, Inc., was $11,896,425. The cost of the whole Canyon Ferry Dam project, when complete and ready to put power on the line, is estimated at about $29,000,000.

Workmen finish assembly of radial gates (each $34^1/_2$ × 51 ft) in top photo. River flow passing over spillway in July is indicated. A 21-ft-wide highway across the crest of the dam, yet to be constructed, will carry road traffic across the river. Part of Montana Section inspection party making Canyon Ferry Dam trip is seen immediately above. Under the hard hats are (left to right) D. W. McCullough; D. H. Park, secretary, Montana Section; W. P. Price, Jr., construction engineer for the project; and J. A. Maierle, president, Montana Section.

Montana Section luncheon meeting, at the Colonial Club in Helena, honors visiting Executive Secretary William N. Carey. Shown seated, left to right, are William P. Price, Jr.; Scott P. Hart; Secretary Carey; Joseph A. Maierle, president, Montana Section; Frank Stermitz, vice-president of Section; George Sahinen; Charles S. Heidel; and Henry C. Helland. Standing, in same order, are Albert W. Jones; Dwayain K. Ford; Shields B. Sanders; Myron C. Lockey; William J. Wenzel; Charles S. King; George J. Hoge; David W. McCullough; Donald H. Park, secretary-treasurer of Section; and E. A. Dalakow.

New officers of the Brazil Section, elected at a meeting held in Sao Paulo on July 23, are Benjamin F. de Barros Barreto, president; Paulo R. Fragoso, vice-president; G. L. Williams, secretary; and Rudolf A. Frey, treasurer. In his speech of acceptance, Dr. Barreto outlined a plan to increase ASCE membership in Brazil by a program of meetings that will provide special inducement for non-members to join the Section. F. T. da Silva Telles then described the driving of the Nove de Julho and Moringuinha tunnels in Sao Paulo.

In June the Kentucky Section brought out an attractive newsletter in the hope that "the projection of news about ASCE and its membership may enable Section members to broaden their fellowship and activities within the Society." An Editor's Note explains that the publication is in the nature of an experiment, with continuation depending largely upon how much support it receives from the Section. D. H. Sawyer is editor.

As a professional service, the Los Angeles Section is taking steps to acquaint public agencies throughout the area with the proper methods of selection of engineering services and fee negotiations by providing them with pertinent material from the ASCE Manual of Professional Practice for Civil Engineers. After considerable study of better ways of serving its widely scattered membership, the Section has formed its first Branch, which will be called the San Bernardino-Riverside Branch and will meet at Riverside.

A field trip to the site of test excavations and fills being made as a preliminary phase in the construction of the Little Rock Air Force Base constituted the July meeting of the Little Rock Branch of the Mid-South Section. The tour was at the invitation of

the Little Rock District of the Corps of Engineers, and conducted by F. W. Sims and L. R. Barnett, Jr., of the Little Rock District office. ASCE Director Norman Moore reported the recent Miami Beach Convention at the July 29 meeting of the Vicksburg Branch. A technical talk—on "Loads on Underground Conduits"—was given by E. F. Bespalow, president of the Mid-South Section.

The Northeastern Section was host, on June 22, to a meeting of the recently formed New England Council. ASCE Director Frank A. Marston summarized Board actions at the Miami Beach Convention. The remainder of the meeting was devoted to program planning for the future. The next meeting of the Council will be held at Tufts College in October in conjunction with the BSCE and ASCE Annual Student Night.

The Sacramento Section has established a Central Valley Subsection, with headquarters at Stockton. On July 21 the Section celebrated its 1,500th weekly meeting with a special evening program. R. Robinson Rowe—N. G. Neare to readers of CIVIL ENGINEERING—was master of ceremonies. In a brief review of the history of the Section, Mr. Rowe noted that its first meeting was held in 1922 with 39 charter members, of whom 23 are still living. The Section now has around 700 members and two Subsections. Entertainment included a humorous discussion of "Nomographs" by Francis N. Hveem that proved highly interesting.

Bingo, croquet, and badminton were the order of the day at the annual picnic held by the Houston Branch of the Texas Section, which emphasized entertainment for the children. A barbecue and dancing concluded the festivities. There were about 60 members and their wives and children in attendance. At a recent luncheon meeting of the Fort Worth Branch, Hubert H. Crane, Fort Worth architect, expressed his views as to how work requiring the services of both architects and engineers can be expedited, in a talk entitled "Professional Relations Between Architects and Engineers."

Reorganized District 7 Council Has Good Meeting

Up in the air-conditioned Upper Peninsula of Michigan an earnest enthusiastic group of 150 members and their ladies joined in a two-day District 7 Conference, as guests of the Michigan Section at Michigan College of Mining and Technology, in Houghton, heart of the copper country. Grover C. Dillman, president of the college, welcomed the visitors to their first session on Thursday, August 6, in an address to which Prof. Dudley Newton, president of the Michigan Section, responded.

ASCE Vice-President Brooks Earnest, in a talk on ASCE affairs, commented particularly on unionism. He urged every young engineer confronted with the question of joining a union to weigh carefully the possible immediate personal benefits against his probable loss of independence as a professional man. Dr. Earnest pointed out that engineers must grow individually in order to meet the requirements of the new industrial technology of today.

Dr. David B. Steinman headed a symposium discussion of a project close to the hearts of the people of the Upper Peninsula, the construction of the proposed bridge across the Straits of Mackinac, by delivering his famous lecture, "Romance of Bridges" illustrated with beautiful colored slides. The Friday morning technical session included papers on the mining and industrial developments of the region.

Three papers were given on the Mackinac Straits Project: "History of the Bridge" by S. M. Foster, bridge engineer, Michigan State Highway Dept.; "The Foundation and Superstructure" by Carl Gronquist, chief engineer of the D. B. Steinman firm; and "Financing" by Lawrence Rubin, secretary of the Mackinac Bridge Authority. It was developed that construction now is in abeyance pending financing the sale of revenue bonds in amount approximating $95,000,000. Engineering and construction alone are estimated at $77,000,000.

Executive Secretary W. N. Carey addressed the August 7th luncheon meeting on increased unity in the engineering profession; the new method of publication and distribution of Proceedings papers; (August issue, page 71); and the prospective activities of the ASCE Committee on Conditions of Practice (August issue, page 69). During the August 7th Conference business meeting, Director Lloyd Knapp, of Milwaukee, reported on the recent ASCE Convention in Miami Beach, Fla.

The Friday morning technical session included papers on the mining and industrial developments of the region. The Osceola reactivation project was described by R. J. Marcotte and R. Spencer. The immediate job consists of dewatering the abandoned copper mine, with maximum pumping depth 5,700 ft. Submerged, direct-driven pumps with motors running in oil are being used.

Some of the moving spirits who arranged the successful regional conference were Prof. W. C. Polkinghorne, head of the department of civil engineering at the host college; George D. Tramp, from Marquette; and E. A. Finney, of East Lansing.

It has been 15 years since District 7 members met in conference in Houghton—when the late Henry E. Riggs was President of ASCE. Not until 1951 when officers of Local Sections in District 7 met in Detroit in conjunction with a meeting of the Executive Committee of the ASCE Board of Direction, were District 7 Conferences resumed. There was a full-fledged conference in 1952 in Milwaukee. Plans have been laid to formalize a District 7 Council and to meet yearly.

Coming Events

Alaska—Second annual meeting at Juneau, October 3 and 4. Business session, Saturday afternoon, October 3; annual dinner in the Gold Room of the Baranof Hotel, Saturday evening; and sightseeing in the Juneau area on Sunday.

Central Illinois—Meeting at the Allerton House, Robert Allerton Park, near Monticello, Ill., September 29. Tentative meeting theme is "Unionism Among Engineers."

Los Angeles—Dinner meeting at Rodger Young Auditorium, 936 West Washington Blvd., Los Angeles. Junior Forum luncheons every Friday noon at restaurants in the downtown area (information from Chuck Gorham, MI. 4211, Ext. 456). Meeting of the Soil Mechanics Group at the Clark Hotel, September 16, at 6:30 p.m. Meeting of the Sanitary Group at Taix French Restaurant, September 23, at 6:30 p.m.

Maine—Joint meeting of the Maine Section and its newly formed New Hampshire Branch tentatively proposed for Portsmouth, N.H., October 8.

North Carolina—Meeting at the Cape Fear Hotel, Wilmington, N.C., September 25.

Oklahoma—Fall meeting at Tulsa, September 19.

Sacramento—Weekly luncheon meetings at the Elks Temple every Tuesday at 12 noon.

Texas—Fall meeting at the White Plaza Hotel, San Antonio, October 15 and 16, preceded by a meeting of the Board on the 14th.

Virginia—Annual fall meeting at the Hotel Roanoke, Roanoke, September 25.

Scheduled ASCE Conventions

NEW YORK CONVENTION
Hotel Statler
October 19–23
1953

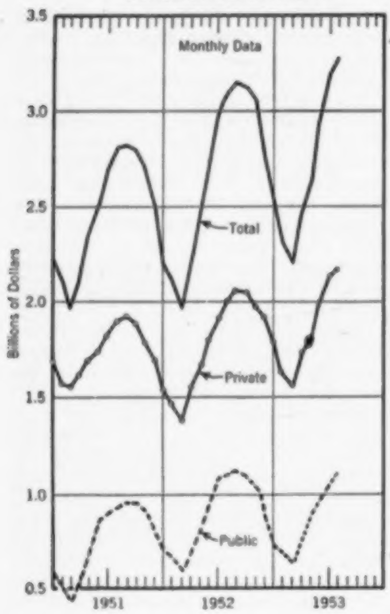
ATLANTA CONVENTION
Atlanta, Ga.
Hotel Biltmore
February 15–19, 1954

ATLANTIC CITY CONVENTION
Atlantic City, N.J.
Chalfonte-Haddon Hall
June 14–19, 1954

NEWS BRIEFS . . .

July Construction Activity Maintains Record Level

Total expenditures for new construction rose slightly in July to a new monthly peak of almost $3.3 billion, 8 percent above July 1952, according to preliminary estimates of the U.S. Labor Department's Bureau of Labor Statistics and the Building Materials Division of the U.S. Department of Commerce. The small July increase (about 2 percent above the June estimate) resulted chiefly from seasonal gains in highway construction and in private outlays for public utilities, plus a more than seasonal rise in commercial construction.



Slight rise in July construction expenditures to new monthly peak of almost $3.3 billion is indicated by Department of Commerce curves.

Private spending for public utilities reached a monthly record of $410 million during the month, and outlays for private residential building (about the same as in June) exceeded $1 billion for the third successive month. Though commercial construction rose 9 percent to $165 million in July, private industrial construction declined more sharply than during the past several months. Total private expenditures for new construction put in place during the month amounted to $2.2 billion—about the same as in June, but 9 percent above July 1952.

Public construction expenditures were boosted 5 percent to $1.1 billion, chiefly the result of a gain in highway work, which rose 9 percent during the month to $360 million. There were also increases in most other major types of public construction, though gains generally were less than seasonal.

Thus far in 1953, new spending records have been established for several types of construction, including private expenditures for new residential building, public utility construction, and commercial and educational building. In the public sector, expenditures for highways and schools also exceeded any previous total. Despite the fact that private industrial construction has been declining since February, expenditures for this work so far in 1953 almost equal the record 1952 figure, when the totals for the first seven months are compared.

Total expenditures for new construction put in place during the first seven months of 1953 amounted to $19.3 billion, a gain of 8 percent over the same 1952 period, and physical volume (expenditures adjusted for price changes) also was up slightly from last year.

Virginia Studies Possible Toll Road Construction

There is sufficient traffic in the Richmond-Petersburg (Va.) area to justify the construction of a north-south toll road, according to a recent report presented to Virginia Highway Commissioner James A. Anderson by Wilbur S. Smith, of New Haven, Conn., whose consulting firm has been making a toll road study for the Department of Highways.

Under the state's Turnpike Act, the Department of Highways has no legislative authority to build toll roads in urban areas. Unless this restriction is removed, the report favors a 40.7-mile "rural" route connecting, but skirting, Richmond and Petersburg. Estimated cost of such a four-lane divided highway is $51,394,000.

The report also recommends necessary changes in the Turnpike Act to permit the Highway Department to carry toll routes into or through all cities, or to create an authority empowered to construct and operate toll roads in the state. Either of these changes would permit construction of a "city" route, the report declared, which would most effectively meet the demands of through traffic and at the same time best serve local needs. The "city" route would be 35.3 miles long, generally parallel to U. S. 1, and would pass through both Richmond and Petersburg. Its estimated cost, based on the same type of construction as for the "rural" route, is $57,252,000.

A report on the feasibility of a toll highway, to relieve traffic in the congested Washington, D.C., metropolitan area in Virginia is expected soon.

Great Lakes Steel to Enlarge Its Zug Island Blast Furnace

With award of a recent contract to Koppers Company, Inc., the Great Lakes Steel Corp. will rebuild and enlarge the "A" blast furnace at its Zug Island Plant near Detroit. The work, which will begin next spring, will double the pig-iron capacity of the furnace—to an approximate annual output of 500,000 tons. When the "A" furnace work is finished, total annual plant capacity will be about 2,000,000 tons. Koppers' Freyn Division has the engineering work under way at this time.

The National Steel Corp., of which Great Lakes Steel is one unit, operates twelve blast furnaces that will have a combined annual pig-iron capacity of 4,800,000 tons.

Contract Awarded for Seyhan Dam in Turkey

Construction of Seyhan Dam in Turkey will go forward following award of a $14,334,451 low-bid construction contract to the firm of Morrison-Knudsen. Located on the Seyhan River at Adana, on Turkey's Mediterranean seacoast, the project will entail a 5,000-ft earthfill dam 225 ft high, a powerhouse that will eventually house three 22,500-kva units, and irrigation features. It will be financed by the International Bank.

Knappen-Tippetts-Abbett-McCarthy are consultants on the project, with Charles F. Travis, A.M. ASCE, special partner for the Middle East, in overall charge of the work. Wallace B. Carr, M. ASCE, will be resident engineer, and W. G. Mitchell, construction engineer.

Delaware River Clean-up Is Well Advanced

The Delaware River's self respect is fast being restored in a sanitary clean-up now headed for completion, according to information furnished by the Sanitary Water Board of the Pennsylvania Department of Health. The clean-up program is notable for the area and population served and for the relatively brief period (ten years), in which the job will have been done.

Untreated sewage and mill and factory wastes had been poured into the river in hundreds of millions of gallons daily until the highly polluted condition of the river compelled state action. Philadelphia, which was already constructing sanitary improvements, revamped its clean-up program to complete its $60,000,000 total of projects by 1953. The program includes the construction of three municipal sewage treatment plants with a joint capacity of 400 mgd, many miles of intercepting sewers up to 10 ft in dia, river siphons, and pumping plants.

In addition, three joint sewerage authorities in eastern Delaware County are engaged in construction of sanitary projects, costing $7,000,000, which will treat the sewage from 27 communities with a joint population of over 200,000. The three authorities together are said to represent the second greatest number of communities in any authority in the country, exceeded only by the Allegheny County Sanitary Authority which includes Pittsburgh and 63 other communities.

One of the largest contributors to the pollution of the Delaware has been the Schuylkill River, into which collieries have been pouring tons of silt in the water used in preparation of coal. Stimulated by orders from the Sanitary Water Board, 47 collieries on the Schuylkill watershed have now installed desilting works that will prevent an estimated 2,000,000 tons of silt and fine sizes of coal from entering the river The Board estimates that industry has spent at least $35,000,000 on pollution-abatement systems in five counties—Bucks, Chester, Delaware, Montgomery and Philadelphia.

Toll Highways Increase

In recent testimony before the Senate Committee on Public Works, Subcommittee on Roads, Gen. Eugene Reybold, executive vice-president of the American Road Builders Association, stated that toll roads are in operation in nine states and under construction in four others.

"Total mileage in operation amounts to 840 miles constructed at a cost of $644 million," according to General Reybold. "In addition, 1,032 miles are under construction, involving an estimated cost of $1,207 million . . . There is at this time an authorized mileage of 477 miles, involving an estimated expenditure of $424 million," he said. Soon there will be 2,349 miles of toll road in operation at a cost of nearly $2,275 million.

Newark Airport Opens New Passenger Terminal

With opening of this new $8,500,000 passenger terminal, Newark Airport will have greatly expanded facilities for both passengers and baggage. Main structure, 600 x 166 ft, contains ticket counters, running full length of structure; centralized baggage claim area; conveniently located concession area providing numerous consumer services; and 500-ft glass-enclosed observation deck. Bearing in mind the rapid obsolescence of many air terminals, the design of this terminal produced a structure that could be easily converted to a hangar large enough to house three Boeing Stratocruisers. To accomplish this, the south half of the roof (side shown in photo) is cantilevered for the full 600 ft of its length. When and if conversion becomes necessary, the glass wall of the observation deck can be removed and replaced with doors. Also shown in photo (foreground) is outdoor observation deck which runs 500 ft along top of west arcade, one of two fingers extending 575 ft south from main terminal, which provides covered access to planes. East arcade is equipped with overhead conveyor for bringing baggage of all passengers to central baggage claim area. Structure was built by the Port of New York Authority, owner of the airport.

ASEE-ECPD Joint Meeting Scheduled for October

A once-in-a-decade joint meeting in New York of the American Society for Engineering Education and the Engineers Council for Professional Development is scheduled for October 14–17 (Wednesday through Saturday). Principal sessions of the meeting, which has for its theme, "Civilization Is Dependent Upon the Growth of the Engineering Profession," will be held at the Statler Hotel, beginning Thursday.

Executives who employ engineers, engineers who are ambitious to broaden their knowledge of their profession, and those who have young men looking to them for advice as to how to approach an engineering career will have opportunity at the joint meeting to discuss latest developments in curriculum and practice with leaders in engineering education.

The Executive Board and the General Council of ASEE will have a full day of sessions on Wednesday. The Thursday program, under the sponsorship of the Engineering College Research Council and the Engineering College Administrative Council, will deal with the topic, "Creativeness in the Arts," in the morning session. For the afternoon the topic shifts to "Creativeness in Engineering." An informal dinner for ECPD members at the Engineers Club will round out the Thursday program.

On Friday ECPD will head up a morning session to discuss engineering accrediting, the weaknesses of the present processes, and the findings of the ASEE Committee on Evaluation of Engineering Education as they relate to accrediting. At luncheon the speaker will be Gen. A. G. L. McNaughton, chairman of the Canadian Section of the International Joint Commission, who will direct his remarks to "Water Problems on the Canadian–U. S. Boundary." Friday afternoon sessions will be devoted to a presentation of plans and results of the ECPD experimental training program in Cincinnati, and to a panel discussion of utilization of engineering manpower. The big annual Engineers' Dinner is scheduled for Friday evening, with Horace P. Liversidge, chairman of the Board of the Philadelphia Electric Co., giving an address on "Industry and Engineering Education."

All members of the constituent societies of ECPD are cordially welcome to attend the sessions on Thursday and Friday. Saturday is open for committee meetings as required. Col. L. F. Grant is chairman of ECPD, and Dr. Grinter president of ASEE.

Index Map Shows Status of Aerial Photography

Aerial photography now covers the entire United States, except for a few Rocky Mountain areas, a small part of Maine, and some of the desert country of Arizona and Nevada. The status of this coverage by federal, state or commercial agencies is indicated on a new index map just made available by the Map Information Office of the U. S. Department of the Interior. The present map, sixth in a series intended to present a periodic inventory of areas in the United States that have been photographed, shows that many projects have been completed since the fifth edition was published in January 1951.

Records pertaining to maps, aerial mosaics, geodetic control, and related data are maintained, in addition to aerial photography data, in the Map Information Office. Requests for such information and for the index map should be sent to the Map Information Office, Room 1038, U.S. Geological Survey, Washington 25, D.C.

Brazil Gets International Bank Loan for Hydro Project

Hydroelectric power development in the state of Minas Gerais, Brazil, will be expedited by a loan of $7,300,000 made by the International Bank for Reconstruction and Development to Centrais Eletricas de Minas Gerais and one of its operating subsidiaries, Companhia de Electricidade do Alto Rio Grande. The loan, which is made for a 20-year term, is guaranteed by the Government of Brazil.

The project includes a dam across the Rio Grande at Itutinga Falls, a powerhouse with two 12,000-kw units, 80 miles of transmission line, and several substations. Its total cost is estimated at $16,000,000. Operation of the plant is expected to start early in 1955 and to be up to full capacity a year later. Most of the power produced will be used by manufacturing and mining industries in the state.

The Itutinga Project was prepared by the Joint Brazil-United States Economic Development Commission in Cooperation with the state of Minas Gerais and the Rio Grande electric company.

Cooper Union Briefs Older Alumni on Modern Science

An interesting experiment in engineering education was undertaken this summer by alumni of The Cooper Union. The plan, developed by the alumni association, assembled alumni who graduated before World War II in a seminar and brought them up to date in chemistry, nuclear physics, electronics, and similar scientific fields.

The session ran for ten days, and was held at the school's 1,000-acre Green Engineering Camp. Classes were held each morning and afternoon and were followed by informal gatherings that continued into the evening. The lectures were presented by members of the faculty of the Cooper Union School of Engineering, and the curriculum was arranged to include background information which may have been forgotten by the alumni.

Shield for Third Lincoln Tunnel Under Contract

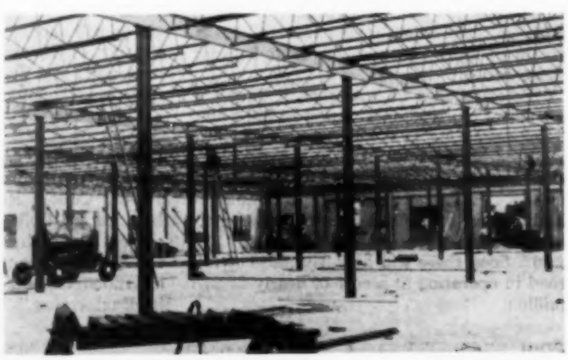
Construction of the third tube of the Lincoln Tunnel under the Hudson River, New York, has advanced to the fabrication of the steel tunnel shield for the under-river section. The contract for the giant shield has been awarded to the American Locomotive Co., for fabrication in Schenectady and delivery in March 1954.

When completed the 240-ton shield will be erected at the bottom of the New Jersey shaft, excavation for which is now under way. The shield, which will be 20 ft long and 31 ft in dia, will require 200 tons of structural steel and plates, plus 40 tons of steel castings. In operation, 30 hydraulic jacks, each of 200-ton capacity, will be installed inside and to the rear of the shield. After the first cast-iron ring section of the permanent outer tunnel lining is bolted into place inside the rear of the shield, the jacks will push against the ring section forcing the shield forward 32 in., so that the next ring can be installed. This process will continue until the shield reaches the New York shaft 14 to 16 months later.

Ground was broken for the $90,000,000 third tube of the Lincoln Tunnel in September 1952. Completion of the third tube is scheduled for 1957.

Use of Precast Concrete Wall Panels Speeds Large Terminal Project

Lift-slab construction makes its debut in New Jersey with the completion of the Entin Industrial Terminal at Clifton. Photo (lower left) shows slab being lifted from previously poured floor by a crawler crane, the bottom of the wall panel in the pouring position becoming the exterior face of the building. Columns were poured integrally with the slab. Joints between slabs were sealed with a sand-cement grout. Bond between the wall slab and floor was broken by use of a paraffin-base solution. Slabs were permitted to set 12 to 15 days before erection, depending on the weather. Floor slab and columns stand on compacted earth fill placed in four layers. The roof, shown in unfinished state (lower right view), is standard 20-gauge metal built-up construction. Construction time for the 40,000-sq ft structure was little over three months, and the cost slightly under $5 per sq ft at platform level with lighting installed. Contractor for the structure was the Mahony-Troast Construction Co., Inc., of Passaic, N.J.



Time-Saving Construction Techniques Reduce Costs on Paducah, Ky., Project of AEC

Paducah, Ky., is the site of the Atomic Energy Commission's new U-235 facility, a billion-dollar construction project begun in January 1951. The prime construction contract is held by F. H. McGraw & Co., on a fixed-fee arrangement. The architect-engineer team is composed of Giffels & Vallet, Inc., Smith, Hinchman & Grylls, Inc., Singmaster & Breyer, and Sargent & Lundy. Two large subcontractors—the M. W. Kellogg Co., and A. S. Schulman Electric Co.—and more than 100 other subcontractors supplement the work of the prime contractor.

There has been a continuous effort on the part of the participants in this uniquely large undertaking to apply advanced practices and techniques, in order to lower the cost and improve the quality of construction. Many of the new time-saving, cost-reducing construction techniques developed have been released from the cloak of security by the AEC. Some of them are shown on this page.

Traffic Controlled at Towers

With a peak employment of 23,000, the problem of parking, traffic control, and the safety of 10,000 private cars departing at the end of working shifts, each driver bent on beating the rush, involved major engineering consideration. Parking lots are carefully located in relation to access roads and to the clock-alleys where workmen stamp their time cards. Physical control of traffic is from a system of five control towers equipped with radio, loud speakers, and traffic lights constructed at strategic points. The success of the control system is evidenced by the daily movement of 8,000 cars at major shift changes from parking area to highways off the construction area in an average of 17 min.

Spread Footings Abandoned

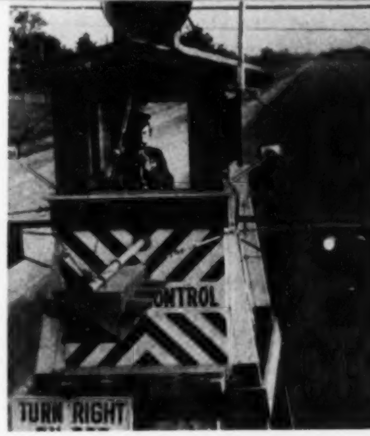
After experience with conventional spread footings on the first buildings on the Paducah project, this type of footing was abandoned in favor of a cylindrical unreinforced concrete shaft formed by pouring concrete into holes which had been enlarged at the bottom to give required soil bearing. The shaft portion of the footing is bored with a straight earth auger to desired depth. A special crane-mounted power tool then flares out the bottom of the hole to form a conical-shaped bell of required diameter. The flaring tool is a combination of two cutting blades and a bucket to collect the loose dirt. This method of constructing footings was applied to shafts having diameters from 2 ft 3 in. to 5 ft 6 in. to depths from 13 to 20 ft, and to a bottom bearing diameter of from 6 to 12½ ft. The method eliminates hand excavation, form work, reinforcing steel, and lead filling. It requires but 50 percent of the man-hours of labor required to construct spread footings for identical buildings. These foundations are being done under a unit price contract by the Bell Bottom Foundation Co., of Houston, and Casey and Case of Los Angeles.

Rolling Scaffold Saves Time

Upper floors of the big structural steel process buildings are of concrete cell construction. Expeditious stripping of the metal floor forms was required to release them for reuse. After trying out several procedures, the method selected consisted of a moving lightweight welded scaffold which can be rolled along 60 ft I-beam track sections mounted at the building columns.

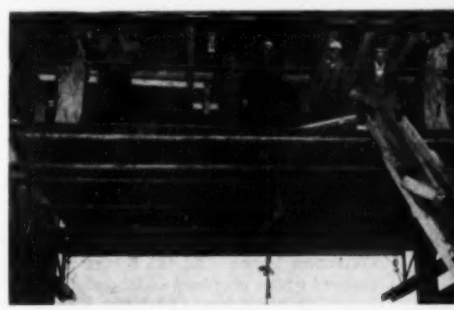
These techniques were developed either from broad management planning or from the practical ingenuity of many craftsmen and supervisors on the job.

F. J. Mayo is project manager for F. H. McGraw & Co. in charge of the work, and E. A. Wende, A.M. ASCE, project manager for the AEC. Frank L. Couch is resident engineer for Smith, Hinchman & Grylls, Architect-Engineer. As staff engineer for F. H. McGraw & Co., Henry W. Phillips supplied the data from which this item was prepared.



From 8,000 to 10,000 private automobiles of 28,000 workmen leave AEC's Paducah construction site at each shift change. An internal and an external circumferential highway built for the purpose discharge traffic on to the existing highway net. Five control towers and a control center are key features.

Bell-bottom holes for building footings are drilled, up to 20 ft deep and 12 ft in bottom diameter, with equipment here illustrated. Earth auger cuts vertical shaft. Rotating bucket at left, with cutter blades which pivot out from their top, cuts out the bell bottom.



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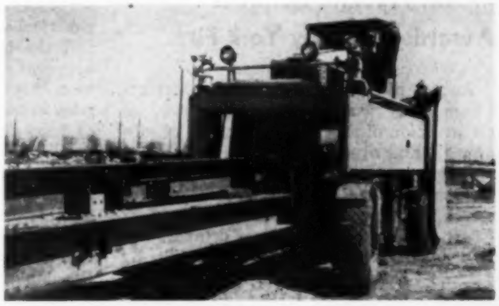
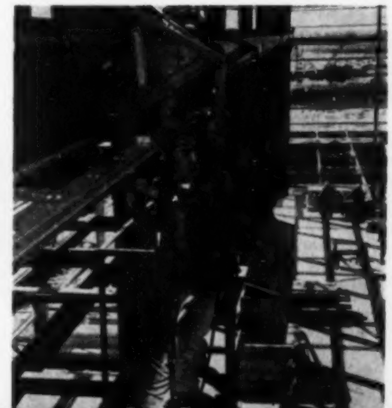
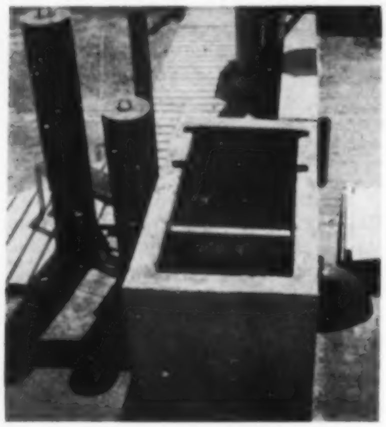
Steel cell floor forms are stripped by workmen standing on a wheel-mounted platform scaffold which rolls on I-beam track sections 60 ft long. As the work progresses the track sections are rolled forward and reclamped to building columns. Another type of rolling scaffold supports workmen at high elevation, who are installing crane trolley ducts, or doing painting. In the photograph (lower right) the scaffold rolls on the permanent crane rail.

→

This type of straddle truck (right) originally intended to handle lumber, proves extremely effective in handling large volumes of small structural sections from stockpiles to buildings at same distance away. Straddle trucks eliminate flat bed trucks and the labor and equipment for loading them.







Radioactive Wastes in Sewage Removed by Trickling Filter Plant

Recently placed in operation in Central Facilities Area, National Reactor Testing Station, Idaho, this domestic sewage plant is designed to remove, also, radioactive wastes from "hot" laundry effluent. (See article in the August issue, page 58.) Upper views, left to right, show sludge drying beds, trickling filter, digester, pumphouse, and primary clarifier. Flow to trickling filter (photo at left) is regulated in this constant-level orifice box by changing size of orifices in dividing wall. Excess flow returns to recirculating pump.

Kansas Selects Toll Road Consultants

Economic feasibility of a toll road connecting Kansas City, Kans., with the Oklahoma border is to be determined by two firms of consulting engineers. The Kansas Turnpike Authority has chosen Coverdale & Colpitts, of New York, to survey the potential traffic and revenue, and Howard, Needles, Tammen & Bergendoff, of Kansas City, to estimate construction costs. The New York firm of Mitchell & Pershing has been retained to advise on the bonds.

Engineering reports on the proposed route will be separate for each of three sections—that is, Kansas City to Topeka, Topeka to Wichita, and Wichita south to the Oklahoma border. At the border it would connect with a proposed Oklahoma turnpike extending north from Oklahoma City.

Ideal Cement Company Dedicates Research Center

A new $500,000 laboratory and research center was dedicated in August at Boettcher, Colo., by the Ideal Cement Co. The center will carry out a full program of scientific research into the production and use of portland cement, and into related fields such as the production of lightweight concrete aggregates. The research program, which has been developed jointly by the company's research director, G. C. Wilsnack, and its research consultant, Robert F. Blanks, general manager of Great Western Aggregates, Inc., contemplates basic research only in fields where existing information is inadequate.

Concerning the laboratory, Cris Dobbins, president of the company, says the facility reemphasizes the company's "belief in product quality," and strengthens its aim of more effective research resulting "in better products and broader usefulness."

Indian Pipeline Contract Awarded to New York Firm

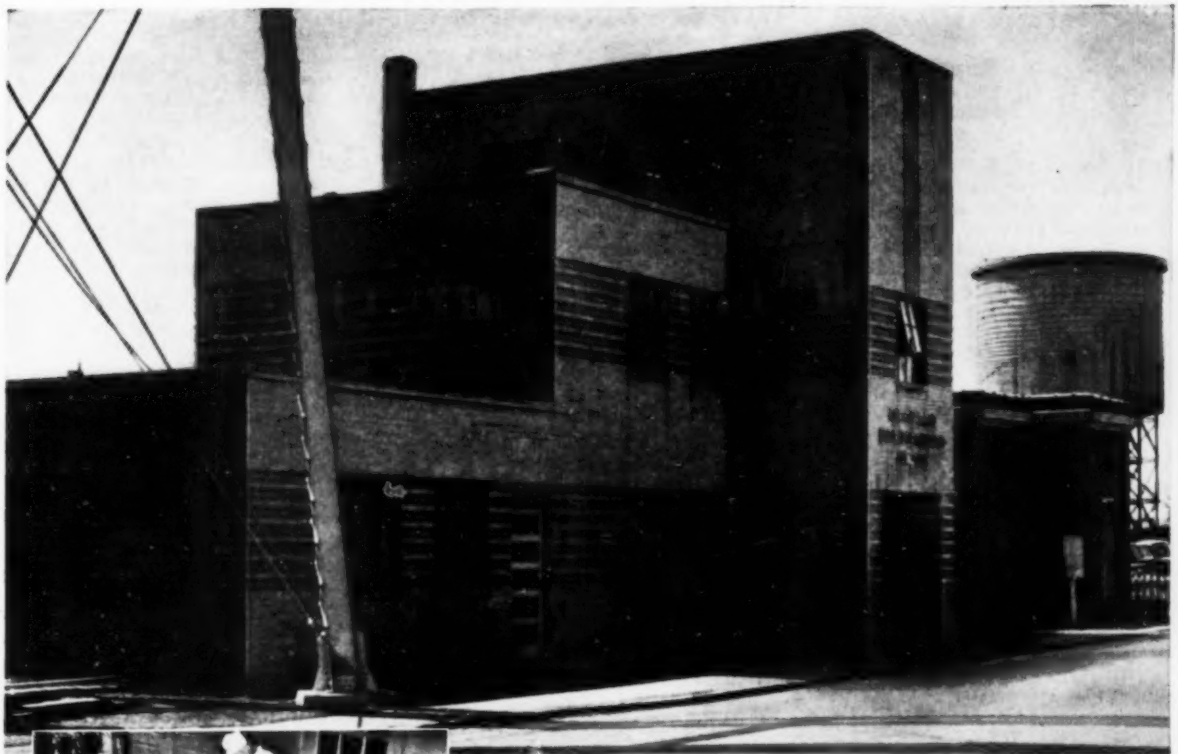
Award of a contract to the Merritt-Chapman & Scott Corp. of New York, for construction of an extensive system of subaqueous and overland pipelines to link two petroleum refineries now being built at Bombay, India, with an offshore marine terminal is announced by the Bombay Port Trust. The project, which is estimated to cost about $4,000,000, will be built by Merritt-Chapman & Scott Corporation of India, a subsidiary of the New York organization, in association with the Hindustan Construction Company, Ltd., of Bombay.

The work will involve the construction of approximately 50 miles of pipeline to provide a network of seven lines between marine terminal piers, $2^1/_2$ miles offshore, and two refineries being built on the outskirts of Bombay—one by Burmah-Shell, the other by the Standard-Vacuum Oil Co.

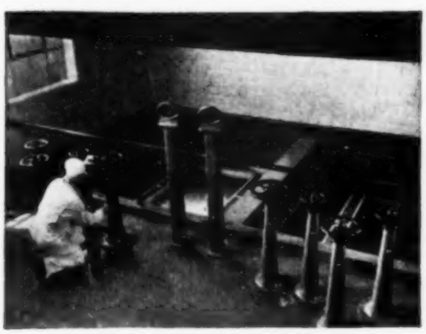
Student Deferment in Selective Service Interpreted

A new book, *Student Deferment in Selective Service*, by Dr. M. H. Trytten, Director of the Office of Scientific Personnel, National Research Council, accurately describes the government's student-deferment program and the philosophy behind it. With the approval of the Director of Selective Service, the Engineering Manpower Commission of EJC has distributed the book to agencies of the selective service system.

While EMC does not necessarily endorse all the statements made in Dr. Trytten's book, it does correctly state how the student-deferment program works and how it affects the security of the nation. Copies of the 140-page book may be purchased from the publisher, the University of Minnesota Press, Minneapolis, Minn., at $3 each.



Staples' compact Permutit Precipitator has 400 gpm capacity. Softens hard well water, removes turbidity, iron, and manganese.



Two 8' x 9' Permutit Gravity Filters remove last traces of suspended matter, deliver a crystal-clear, softened water.

How *Staples, Minnesota gets soft, clear water*

Staples' well-water supply caused plenty of trouble . . . total hardness 275 ppm, alkalinity 200 ppm, iron 3 ppm, turbidity 30 ppm. To solve these problems, Staples turned to Water Conditioning Headquarters.

Now Mr. E. H. Klang, Supt. of the Water and Light Dept. reports the Permutit-treated water "very fine in all respects—very clear."

Permutit recommended the equipment shown at left, plus a carbonation tank. Turbidity is reduced to only 3 ppm . . . iron to 0.1 ppm. Hardness and alkalinity are reduced to specified requirements. Because of high Precipitator efficiency, each filter is backwashed only once a week for 20 minutes.

"The Precipitator has not given any trouble. The Permutit filter is one of the best . . . has been trouble-free," adds Mr. Klang about the Permutit equipment installed in 1939.

Free Technical Bulletins

Write today for full information on any water conditioning process or problem. The Permutit Company, Dept. C-9, 330 West 42nd Street, New York 36, N. Y.

WATER CONDITIONING HEADQUARTERS
FOR OVER 40 YEARS

PERMUTIT®

Sandwich-Wall Construction Speeds Aircraft Plant Expansion

The first sandwich wall, precast concrete building in the New York–New England area is under construction at Calverton, N.Y. The structure will house the Grumman Aircraft Engineering Company's new Long Island plant. The technique consists essentially of precasting slabs weighing nearly two tons each, transporting them by truck to the site and bolting them into position on the steel frames of the seven buildings comprising the plant. The massive slabs, most of them 8 × 10 ft, have a textured surface and bear some resemblance to Indiana limestone.

While the economics of the job cannot be accurately determined until the plant is completed, a very rough idea of the savings can be estimated from the fact that nine men and a crane can install about 30 panels a day, which cover about 2,400 sq ft. In addition to cutting down the amount of field labor, the method eliminates a number of corollary costs such as wheelbarrows, scaffolding, and cleanup. It is flexible, as the panels vary from very small to the 8- by 10-ft size in which most are cast. Although the panels are only 5 in. thick, their U-value is 0.14. A layer of Fiberglas insulation in the center of the panels accounts for the low heat transfer.

In the first phase of the casting process, the steel frames are oiled with a parting agent. A sheet of muslin, which gives a slightly textured appearance to the inside face is then laid on the bottom plate. Perimeter rails are fastened and the first layer of steel reinforcing mesh is placed 1 in. above the bottom of the form. A layer of concrete from a 1½-cu yd bottom-dump bucket is delivered and thoroughly vibrated. A team of workmen then lays sheets of 1½-in. Fiberglas insulation on the fresh concrete, which is unaffected by moisture, will not rot, is inorganic, and will last the life of the building.

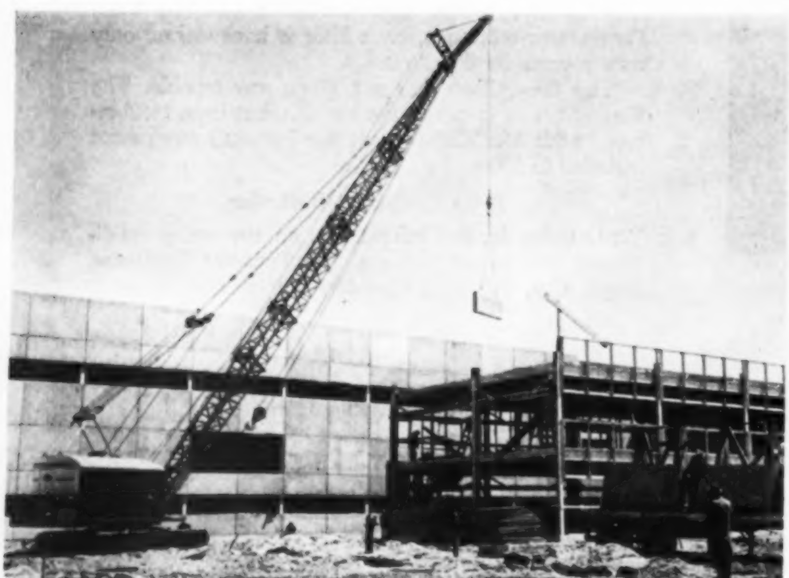
Remaining steps consist of placing a second layer of wire mesh, dumping a second pour of concrete, vibrating the mix and smoothing the surface with a large wooden float. This surface, the outer one, is given an overall series of fine, parallel grooves by drawing a broom across it while it is still plastic.

Panels remain in the forms for about 20 hours and are then taken by overhead crane to the nearby curing chamber, in which 100 percent humidity and 120-degree temperature are maintained, where they remain 24 hours. U-bars are cast into the top of each panel for handling by crane. Four socket anchors in each slab on the inside face are the means by which the panels are bolted to the framework of the building.

Emplacement of the panels on the steel frames of the buildings involves little more than lifting the panels into position and inserting bolts from the inside of the building.

The panel-casting operation is being done by Precast Building Sections, Inc., of New Hyde Park, L.I., about 50 miles from Calverton, in association with the Marietta Concrete Corp. of Marietta, Ohio, which supplied metal forms and advisory services. This technique was developed originally by Marietta Concrete and Ford, Bacon and Davis, New York engineering firm. Architect-engineers for the Grumman plant are the office of Alfred Easton Poor and Seelye, Stevenson, Value and Knecht.

Workmen lay Fiberglas insulation 1½ in. thick over the first pour of concrete (top photo left). Insulation will be covered by second pour of concrete. Note socket anchors near corners. This panel will form part of the curtain wall for new aircraft plant. Securing lift cable to U-bars (left) is simple operation for one man in loading slabs on trailer for shipment to construction site. Trailer and slabs are left on site as truck-tractor returns to casting yard at New Hyde Park, N.Y., 50 miles away, with unloaded trailer. In view below (left) trailers are spotted at erection site and panels are placed by crane directly from trailer bed. Panels are bolted to steel frame of building. Bolting panels to frame is simple operation, as shown in photo at lower right. Crew of nine and a crane can install 30 panels a day, or about 2,400 sq ft of wall.



N. G. Neare's COLUMN

R. ROBINSON ROWE, M. ASCE

"Professor Neare must be late," fretted Joe Kerr.

"Wrong guess again," jeered Cal Klater. "Here's a postal from him, postmarked 'Tony Falls' saying that he won't be here tonite because he's fishing the Falls for hydraulic puzzles during the IAHR-ASCE-AGU hydrollery. He adds that Stoop Nagle will continue as Guest Professor."

"Which I was just ready to do," said Professor Nagle. "Our problem, you remember, was to find the largest of seven deltoid stalls in the Deltopolitan market place, outlined in our figure. From Joe's anxiety, I presume he has an answer."

"I have *the* answer," bragged Joe. "Being a good draftsman, I simply redrew the figure on a large scale and planimetered the seven triangles, with the following results:

ABD	11.98	*BDE*	12.02
BCE	11.95	*CEF*	11.99
CAF	12.00	*DEF*	12.03
AFD	12.04	*ABC*	84.01

"I had computed the area of the 13-14-15 triangle as exactly 84, which I checked so closely with my total. So *AFD* was the largest stall, and I want to say that the problem was very ingenious in making the seven areas so nearly equal. I suppose they would have been equal in an equilateral triangle."

"Joe should have suspected," scoffed Cal Klater, "that the problem was more ingenuous than ingenious and sharpened the stylus of his planimeter. My approach was Cartesian, starting with the coordinates $A = (0, 0)$, $B = (14,0)$ and $C = (5, 12)$ and computing $D = (33/7, 12/7)$, $E = (66/7, 24/7)$ and $F = (34/7, 48/7)$. I had intended computing the seven areas by the *DMD* method, but the coordinates of D and E made it obvious that $AD = DE$, giving me the clue that $BE = EF$ and $CF = FD$, which were easily proved. It was then evident that each pair of adjoining triangles had equal bases and altitudes, so that all seven were equal and there was no largest at all. Of course, if the walls separating the stalls had a sensible width, the net areas within the walls would not be equal, and *DEF* with the least perimeter would have the most elbow room."

"Such pragmatism is reprehensible in geometry," chided the Guest Professor. "I merely wanted you to find the seven triangles equal and asked for the largest to avoid giving away the answer. I'll add that topology simplifies the analysis, for any elastic transformation of the figure preserved the ratios of areas, permitting removal of C to $(0, 14)$ so as to work on a right isosceles triangle.

"This easy problem was designed to lead to a more general and interesting sequel. The essence of the construction is that *DEF* is an aliquot part (1/7) of *ABC*, that AA' was drawn to a unit mark on *BC*, and that BB' and CC' divided the other two sides in the same ratio. Making $BA' = 10$ instead of 5 would have had an analogous result. By a very simple rule, four other pairs of solutions can be found for the 13-14-15 triangle. With only 18 points to try, Joe should find one in five trials, but I'll expect Cal to find the rule."

[*Cal Klaters were: Richard Jenney, Kum Pewter (Walter Steinbruch), T. J. Ogburn III, Flo Ridan (Charles G. Edson), Francis E. Simpson, S. K. Rueball (Keith Jones), CACOSFBOE (City and County of San Francisco Bureau of Engineering), Sauer Doe (Marvin Larson), Rudolph W. Meyer, and Julian Hinds. The Guest Professor is John L. Nagle.*]

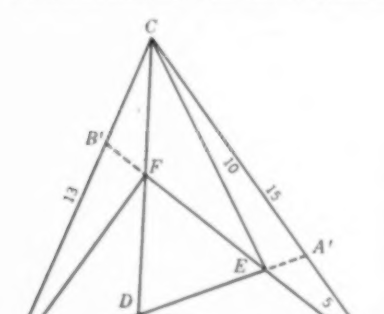


FIG. 1. Adjoining triangles have equal bases and altitudes, so all are equal.

EMC Is Concerned with Army Assignments

The Engineering Manpower Commission of Engineers Joint Council is much concerned with the efficiency of the U. S. Army Scientific and Professional Personnel Program. This program should be of special interest to recent engineering graduates who will shortly be inducted into the armed forces because it was designed to channel as many of them as possible into Army billets which will insure maximum utilization of their engineering or scientific training and experience for their own continued professional development as well as for the advancement of the Army's technical programs.

The basic program is described in detail in Department of the Army Special Regulation No. 615-25-11, dated August 7, 1952, available from the Department of the Army, Washington 25, D.C.

The regulations provide for the identification, classification, assignment, and utilization of persons qualified to perform duties at scientific and professional level in research and development, instruction and related work of professional or scientific nature. Commanders of reception centers and other installations conducting initial reception processing are responsible for the proper identification and indoctrination of scientific and professional personnel and for their transfer to appropriate basic training.

Regulations concerning the selection of Scientific and Professional Personnel differ for each major scientific and professional field. In some cases, only a B. S. degree is required. In others, a bachelor's degree, plus a certain amount of experience, or an advanced degree is required. Personnel qualified as "Scientific and Professional" are assigned a Military Occupational Specialty number (MOS) which reflects their specialty and is intended to be used as a guide in their assignment to billets in which their training and experience will be utilized.

EMC feels that the dissemination of information regarding the existence of the program is vital to its success. Information regarding engineers and scientists qualified under the program who are not being utilized in their fields of special qualification, should be sent to T. A. Marshall, Jr., Executive Secretary EMC, 29 West 39th St., New York 18.

Tractor Scraper Grading Hauls Stretched Out

Over the past five years the Bureau of Public Roads (Production Cost Unit) has made 9,000 observations on 23 random-selected grading jobs concerning length of haul on 71 crawler-tractor and scraper combinations ranging in size from 6- to 28-cu yd struck capacity. The average observed travel distance from end of loading to start of dumping was 565 ft. The longest haul observed was a single load for 3,600 ft.

In Fig. 1, here reproduced from a report of a Special Committee on Highway Equipment of the Highway Research Board, it is to be noted that three-quarters of the observed hauls were under 800 ft.

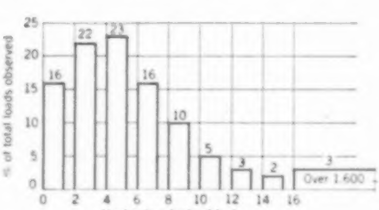


FIG. 1. Percent distribution of total loads is shown by various increments of apparent haul in chart reproduced from report of special Highway Research Board committee.

DECEASED

Hazim Majid Abdul-Nour (J.M. '50), age 28, instructor at the engineering college of Baghdad, Iraq, from 1950 to 1952, was killed in an automobile accident on March 3, 1952. Mr. Abdul-Nour graduated from the college in 1946, and received a master of science degree from Harvard University in 1950. In the intervening years he was employed as a technical overseer in the Baghdad public works department.

James Byrnside Akers (M. '40), age 69, chief engineer of the Southern Railway System, Washington, D.C., died in that city on July 8. Engaged in railroad engineering for 49 years, Mr. Akers joined the Southern system in 1904, at Asheville, N.C., advancing to assistant to the vice-president in 1924, assistant chief engineer in 1931, and chief engineer in 1946. He served as director and president of the American Railway Engineering Association. Mr. Akers attended Washington and Lee University.

J. B. Akers

Albert Bernhardt Collins (A.M. '32), age 59, utilities engineer with the Los Angeles County Flood Control District, Los Angeles, Calif., died on March 13. After graduating from the University of Southern California in 1925, Mr. Collins became connected with the Flood Control District, which he served continuously throughout his career except for six years (1944–1950) with the U.S. Navy.

Robert Franklin Ewald (M. '31), age 72, who retired from the Aluminum Company of America in 1947, after 35 years in the hydraulic engineering department, died at his home in Mt. Lebanon, Pa., on July 17. He was a graduate of the University of Wisconsin, class of 1905. For a five-year period he worked for the U.S. Reclamation Service and the St. Lawrence Power Co., joining Alcoa at Knoxville, Tenn., in 1912. Mr. Ewald participated in early studies for Cheoah and Fontana dams.

Frederick Ernest Giesecke (M. '13), age 84, consulting engineer of New Braunfels, Tex., died on June 27. An authority in the field of heating and ventilating, Dr. Giesecke taught for nearly half a century at Texas A. & M. College (1886–1912, 1927–1945), and for 15 years at the University of Texas (1912–1927). He served as president of the American Society of Heating and Ventilating Engineers in 1940. Dr. Giesecke held degrees from Texas A. & M., M. I. T., and the University of Illinois.

Ulysses Sumner Grant (A.M. '28), age 62, partner in the firm of U.S. Grant & Son, Santa Barbara, Calif., died on November 20, 1952. For many years Mr. Grant served as chief engineer for O. H. O'Neill, Santa Barbara consultant. In 1930 he formed a partnership called Grant & Evans, which was succeeded by U. S. Grant & Son. In World War II he was a civil engineer in the Navy department at San Diego. Mr. Grant was an alumnus of the University of Wyoming.

Martin Sigvart Grytbak (M. '30), age 70, bridge engineer for St. Paul, Minn., for 40 years, died on June 24—a week before his retirement. Before entering municipal service Mr. Grytbak was employed as a bridge engineer by the Northern Pacific Railroad. He played an important role in the design of the Ford Bridge over the Mississippi, for which he was chief engineer. He also designed and supervised construction of most of the Kellogg Boulevard improvement. He was an alumnus of the University of Trondheim, Norway.

Howard Holbrook (M. '51), age 69, consulting engineer of Jamaica, N.Y., died on April 1. Mr. Holbrook was connected with the New York City Board of Transportation from 1910 until his retirement in 1951, attaining the position of senior civil engineer. During his long tenure with the Board he was engaged on several major subway projects.

Francis Dey Hughes (M. '12), age 80, retired bridge engineer of Austin, Tex., died at his home on July 1. Before entering private practice in 1927, Mr. Hughes was employed by several bridge companies including the Illinois Steel Bridge Co., where he was design engineer from 1905 to 1925. As a consultant he planned and executed such projects as the International Bridge at Laredo, Tex., the bridge over the Royal Gorge in Colorado, and viaducts over the Trinity River at Dallas and Fort Worth. Mr. Hughes studied at Spaldings College, Kansas City.

Charles Henry Hurd (M. '12), age 80, consulting engineer of Indianapolis, Ind., since 1918, died at Ft. Lauderdale, Fla., on July 9. A specialist in the design and construction of sewage treatment plants and water purification systems, Mr. Hurd was engaged by municipalities throughout Indiana and the Midwest. He is credited with numerous innovations in the water purification and sewage treatment fields, including a spiral system of sewage treatment in use in most leading cities.

Joseph Eugene Jewett (M. '38), age 53, chief of the engineering division, Upper Mississippi Valley Division, Corps of Engineers, died in St. Louis, Mo., on July 20. Joining the Corps in 1930, Mr. Jewett served in the Upper Mississippi Valley Division Office at St. Louis for 15 years and at Rock Island, Ill., for 8 years, and received the Meritorious Civilian Service Award in 1951. Before joining the Corps, he was with the City of Miami, Fla., in an engineering capacity, and taught engineering subjects at Oklahoma A. & M. College. He was an alumnus of the University of Illinois.

Marion Elbert Mills (M. '48), age 70, professor of civil engineering and member of the faculty at the University of Oklahoma since 1927, died at Norman, Okla., on June 19. Before he began to teach, Professor Mills was engaged as chief engi-

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Please supply all information requested before September 30, 1953.

FOR ASCE MEMBERSHIP DIRECTORY

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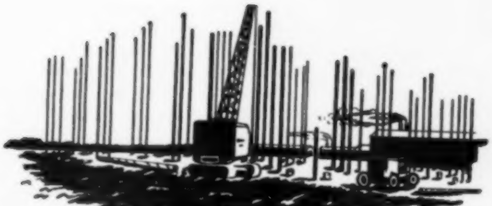

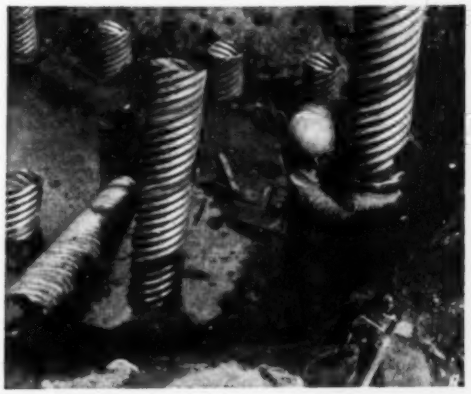

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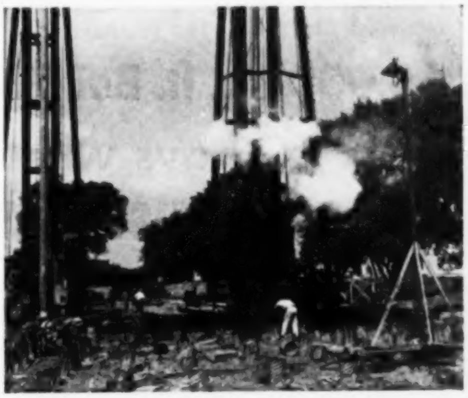

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neer for the Truscon Steel Co., Dallas, Tex., and as structural design engineer for Wyatt C. Headrick, Inc., Fort Worth, Tex. He was an alumnus of Purdue University.

James Fulton Oliver (J.M. '50), age 30, junior engineer with Ensco Derrick & Equipment Co., Houston, Tex., was killed in an airplane accident on March 12. Mr. Oliver joined the Ensco organization in 1950, following his graduation from the University of Texas with the bachelor of science degree in civil engineering.

George Rockwell Putnam (M. '03), age 88, who retired in 1935 as Commissioner of Lighthouses of the United States after 25 years of service in that position, died at his home in Washington, D. C., on July 1. Beginning his career with the Coast and Geodetic Survey in 1890, he made boundary surveys of Mexico and Alaska, and served on assignments in Greenland and the Philippines. Mr. Putnam, was an alumnus of Rose Polytechnic Institute and the Stevens Institute of Technology, and the author of several books on charts and lighthouses.

David Robertson (M. '12), age 81, retired engineer of Vineland, N.J., died on June 18. Mr. Robertson studied at the Michael Todd School of Applied Mechanics and Design in Scotland. For several years he was employed by steel and bridge companies in Pennsylvania and Virginia, including the Virginia Bridge and Iron Co., the American Bridge Co., Carnegie Steel Co., and the Keystone Bridge Co. He was also engaged as assistant design engineer for the New York and New Jersey Bridge and Tunnel Commission in New York for a five-year period.

Nathaniel Sterns Thayer (M. '44), age 60, assistant engineer with Charles T. Main, Inc., Boston, Mass., died recently. Mr. Thayer was connected with the firm for 13 years, serving on assignments in Mississippi and Tennessee for several years. Previously he had been employed by the Works Progress Administration, the Brockton (Mass.) Gas Light Co., and the Nobles County (Minnesota) highway department. Mr. Thayer attended Dartmouth College.

Ralph Newcomb Tracy (M. '45), age 57, division engineer for the Armco Drainage & Metal Products Co., Denver, Colo., died in that city on July 10. He was a graduate of the University of Nebraska. Connected, since 1930, with R. Hardesty Manufacturing Co., an Armco subsidiary, at Denver, he served as chief engineer on design and promotion of Armco products throughout the west. Earlier Mr. Tracy had been city engineer of Fairbury, Nebr. He was a veteran of World Wars I and II.

Lazarus White (M. '21), age 79, a member of the New York firm, Spencer, White & Prentis, which he helped to organize in 1919, and former president (1919–1949), died at his home in Larchmont, N.Y., on July 31. Mr. White had served as consulting engineer for the federal government, the New York World's Fair, the City of Detroit, on the construction of Mississippi River locks and dams, the Sixth Avenue subway, and the foundations of many New York skyscrapers. His firm also handled the underpinning of the White House foundations during its recent remodeling. He originated a widely used method of underpinning, called the "Pretest System" in association with E. A. Prentis. Active in ASCE affairs he was Director from 1940–1942, and chairman of the Committee on Soils and Foundations. Mr. White was a graduate of Columbia University, class of 1897.

Lazarus White

Clement Wayne Wright (A.M. '38), age 52, died in Egypt on December 4, 1952, while engaged on an assignment for the Fluor Corp. Mr. Wright had been in the New Mexico State Highway Department; designing engineer and office engineer in the Phoenix, Ariz., City Engineer's Office; and director of operations for the Soil Conservation Service at Window Rock, Ariz., in charge of the reclamation of a 16,000,000-acre Navajo Indian reservation.

NEWS OF ENGINEERS

Harry L. Bowman succeeds **Dr. Robert C. Disque** as dean of the College of Engineering and dean of the faculty at the Drexel Institute of Technology. A member of the Drexel staff since 1926, Professor Bowman has been serving as head of the civil engineering department. He is author and co-author of books on structural theory, and since the war has been consultant for the Atomic Energy Commission on bomb-resistant structures.

George H. Echols, chief engineer for maintenance of way and structures of the Central Lines of the Southern Railway System at Knoxville, Tenn., has been named to succeed the late **J. B. Akers** (see page 90) as chief engineer of the system with headquarters in Washington, D. C. Continuously connected with the railroad company for 29 years, Mr. Echols has held assignments in Rome and Atlanta, Ga., Jacksonville, Fla., and Knoxville, Tenn.

George H. Echols

James W. Follin, director of the Office of Contract Settlement in the General Services Administration, has been named director of the Division of Slum Clearance and Urban Redevelopment. Engaged in federal service since 1933, he has been with such agencies as the Home Owners Loan Corp., the Federal Home Loan Bank Board, and the National Production Authority.

Albert N. Gonsior, director of plant engineering and maintenance for P. Ballantine & Sons, Newark, N.J., was recently awarded a gold and diamond pin for fifteen years of service.

Edgar E. Foster, engineer in the Denver Hydrology Branch of the Bureau of Reclamation's Project Planning Division, plans to retire when he completes a Point 4 assignment in Iran in September. Mr. Foster has made hydrologic investigations and studies for the Bureau in Guam, the Ryukyus, Nicaragua, and Southern Rhodesia.

John T. Robinson has accepted an appointment as director of project development for Francis H. Bulot, Consulting Engineers, Inc., of Pasadena, Calif. Mr. Robinson has been engaged in industrial waste disposal and other phases of municipal engineering for the past 15 years.

Gordon R. Williams, associate and hydraulic engineer for the New York firm of Knappen-Tippetts-Abbett-McCarthy, was recently appointed associate professor of hydraulic engineering at Massachusetts Institute of Technology. He will continue to consult with Knappen-Tippetts-Abbett-McCarthy on projects with which he has been connected.

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Walden Wren is now assistant manager and chief engineer of the Universal Concrete Pipe Co., Columbus, Ohio. He was formerly products engineer. Other staff changes include the transfer of **Robert Gates** from the Tampa, Fla., area to the company's new plant near Miami as acting manager, and the appointment of **Billy Sumner,** of Nashville, Tenn., as plant manager there. Among new personnel are **William Haley,** who has joined the company as a sales engineer at the Rochester plant, and **Philip Ostendorf,** who will head a new department to be announced soon.

George Schumann, until recently chief design engineer for Kaiser Engineers, Inc., Oakland, Calif., has been named to the newly created position of chief design consulting engineer for the company. Mr. Schumann has been connected with Kaiser Engineers since 1946. Replacing him as chief design engineer is **F. B. Tobias,** who joined the Kaiser organization in 1941 after graduation from the University of California.

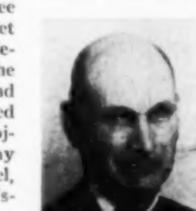
Arvin S. Wellborn, formerly managing engineer of the Pacific Coast Division of the Asphalt Institute, in San Francisco, is now chief engineer of the Institute, with headquarters in New York City.

P. A. Franklin retired on August 1 as design engineer for the U.S. Steel Corp., in Pittsburgh, Pa., and is entering private practice in Pittsburgh. Author of a widely used structural engineering text, Mr. Franklin became connected with the U.S. Steel Corp. in 1940.

John B. Powers, for the past four and a half years manager of the Texarkana Water and Sewer Systems, Texarkana, Tex., recently joined the W. S. Dickey Clay Manufacturing Co., Texarkana, as an engineering representative.

Harold F. Sommerschield has been appointed assistant to the manager of the Capitol Steel Division of the Hausman Steel Co., Toledo, Ohio, with headquarters in Lansing, Mich. Prior to his leaving Chicago, he was chief engineer for the Abell-Howe Co., Chicago contractor.

John A. Morin took office as city engineer of Oakland, Calif., on July 1. Mr. Morin has been an employee of the Oakland Street and Engineering Departments for the past 14 years, and has been associated with such major projects as the Broadway Low Level Tunnel, the Government Island Wharf, the Humboldt Bay Sea Wall, the Point Arguello Breakwater, and the 12th Street Dam Traffic Interchange. He succeeds **Charles A. Reed,** who recently retired as city engineer.



John A. Morin

Douglas S. Jennings, now serving as civil engineer for the Chemstrand Corp., at Wilmington, Del., has been named civil engineer in the projects and standards depart-

(*Continued on page 98*)

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ment of the organization's nylon manufacturing and processing center under construction at Pensacola, Fla.

Robert C. Johnson, president of the Siesel Construction Co., Milwaukee, Wis., has been promoted to rear admiral in the Civil Engineer Corps, Inactive Naval Reserve, one of the few promotions to that rank since World War II.

Robert P. Kalin is now engaged in the construction of industrial and school buildings in New York City for the Kalin Construction Co., following 18 months with the Corps of Engineers in the Philippines.

Hugh MacDonald, of Los Angeles, has accepted a position with the Structural Clay Products Institute in Chicago, Ill. Until recently junior engineer with the Associated Brick Manufacturers of Southern California, Mr. MacDonald has been secretary-treasurer of the Junior Forum of the Los Angeles Section.

Charles F. MacNish succeeds the late **J. E. Jewett** as chief of the Engineering Division of the Upper Mississippi Valley Division of the Corps of Engineers. In the Corps for 22 years, Mr. MacNish has been serving most recently as assistant to the chief of the engineering division.

John J. Manning, former chief of the Navy's Bureau of Yard and Docks, has joined Kelly & Gruzen, a firm of New York architects and engineers, as technical director in charge of engineering. Admiral Manning, USN (retired), has been serving as president and chairman of the board of James Stewart & Co., Inc., New York, since his retirment from the Navy.

O. J. Marsten retired on August 1 as engineer in the erection department of the Bethlehem Steel Co., Belthlehem, Pa., after 47 years with the company and its predecessor organization, the Pennsylvania Steel Co.

Verne O. McClurg, Morrell M. Shoemaker, and **William M. McClurg** announce the formation of the architectural and engineering firm of McClurg, Shoemaker and McClurg to succeed Jensen and McClurg. Its offices will be at 39 South La Salle St., Chicago 3, Ill.

D. B. Steinman, bridge consultant of New York City, received several honorary degrees from European universities during the past commencement season. These include the doctor of civil engineering degree from the University of Bologna in Italy, and doctor of science degrees from the University of Ghent in Belgium, and Minerva University in Italy.

E. D. Uhlendorf has been promoted from senior vice-president in charge of engineering to vice-president and consultant for Pioneer Service & Engineering Co., Chicago, Ill.

Henry A. Alderton, who has represented the U.S. Bureau of Public Roads in Southern California for the past several years, has been transferred to Alaska as district engineer for the Seward District, which covers the territory west of the Yukon boundary.

George P. Steinmetz has received confirmation of his recent appointment as Pub-

(*Continued from page 98*)

lic Service Commissioner of Wisconsin. He was previously chief engineer of the State Public Service Commission, with headquarters at Madison.

R. A. Haber, chief engineer of the Delaware State Highway Department, has been named engineering consultant—the second such appointment in the history of the department. Associated with the department since 1936, Mr. Haber became chief engineer in 1951. The present director of the Delaware Memorial Bridge, **Col. William A. McWilliams,** of Dover, will become chief engineer. Except for a brief period in 1937, Colonel McWilliams has been a member of the staff since 1920.

R. A. Haber

Milton Schmidt has been promoted from associate professor of civil engineering at the University of Illinois to professor of civil engineering, and **John W. Briscoe** and **Anestis Veletsos** have been promoted to assistant professors in the same department. Other promotions include **Bernt O. Larson** to professor of general engineering; **Winston E. Black** to professor of theoretical and applied mechanics; and **Clyde E. Kesler** to associate professor of theoretical and applied mechanics.

RECENT BOOKS

Annual Review of Nuclear Science
Volume II, 1953

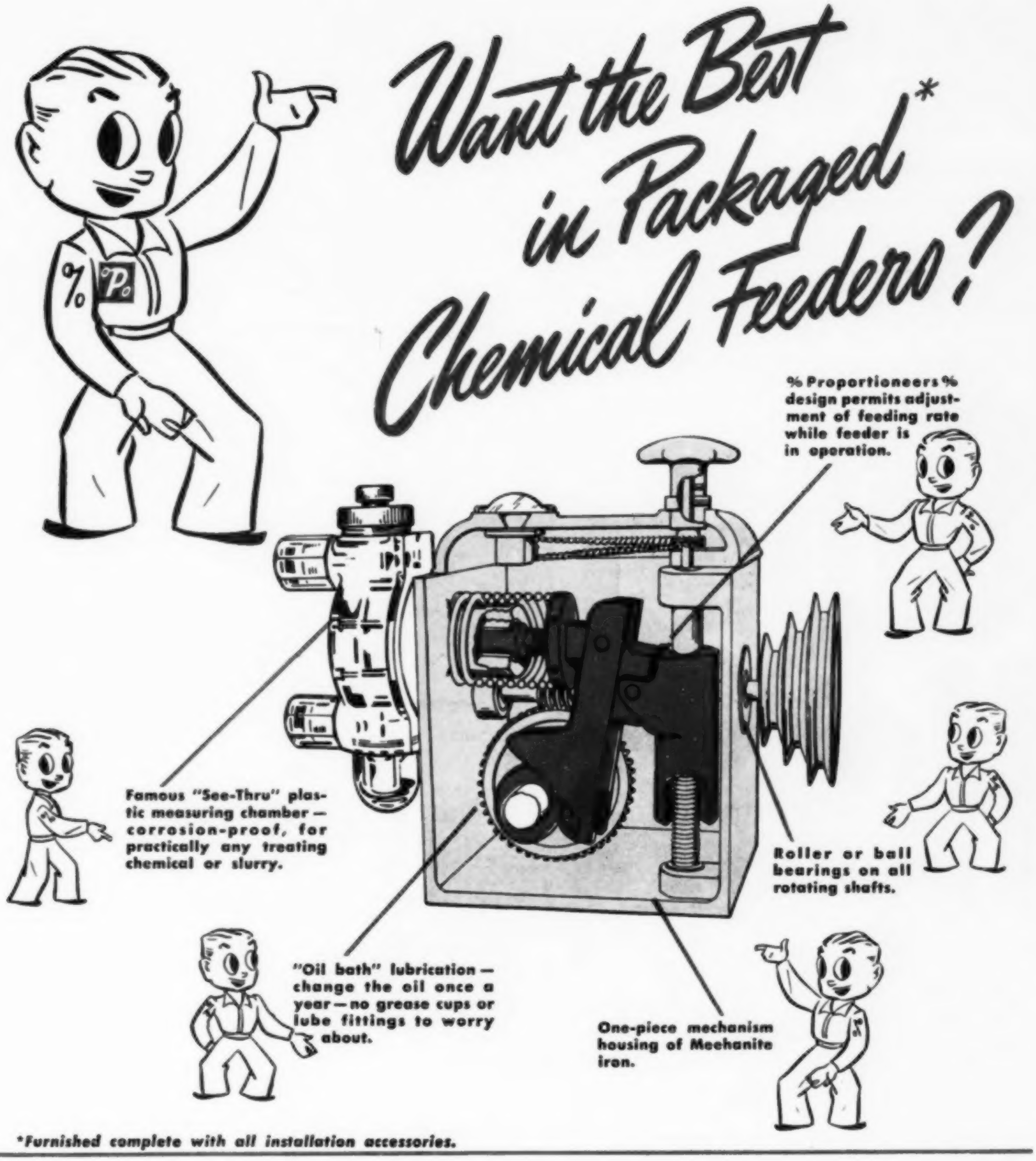
The sixteen papers contained in this volume cover a considerable range of topics, including the following: Origin and distribution of the elements, production and distribution of natural radiocarbon, recent progress in accelerators, nuclear and photonuclear reactions, subnuclear particles, radiation effects in solids, isotopes, nuclear moments, cosmic rays, and high-energy fission. (Annual Reviews, Inc., Stanford, Calif., 1953. 429 pp., $6.)

Basic Mechanics of Fluids

This textbook for junior students, by Hunter Rouse and J. W. Howe, is similar in theme to Professor Rouse's *Elementary Mechanics of Fluids* (1946), . . . completely rewritten, with minor rearrangements of material. Major subjects covered are the principles of fluid statics; kinematics of fluids; the effects of weight, viscosity and compressibility; resistance to flow under various conditions; and a brief chapter on lift and propulsion. General methods of analysis are stressed rather than isolated procedures, and the emphasis on useful application is shown in the problems as well as in the text. (John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y., 1953. 245 pp., $4.50.)

Concrete Mix Design

Emphasis in this publication—Melbourne Technical College Research Bulletin No. 2—by L. Boyd Mercer, is on the production of quality concrete from readily available materials and with modifica-


Want the Best in Packaged* Chemical Feeders?
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tions of mix design methods. The aim is to demonstrate the best use of "badly graded" materials. Quality of cement, type and grading of aggregates, influence of water-cement ratio, and a number of other variable factors such as quality of water, temperature, and mixing are treated from the standpoint of practical application. (Melbourne Technical College Press, Melbourne, Australia, 1953. 59 pp., 5s.)

Engineers as Writers

A text for instruction in technical composition, presenting selections from the works of fifteen engineering writers of different periods and fields. Each selection is followed by a critical analysis, suggestions for study, and topics for oral or written reports. The selections—running from Vitruvius and Agricola to Taylor and Hoover—are, for the most part, suitable for students in any field of engineering, and readily understandable to the layman. A few highly specialized writings are included by the editors, Walter J. Miller and Leo E. A. Saidla. (D. Van Nostrand Company, Inc., 250 Fourth Avenue, New York 3, N.Y., 1953. 340 pp., $4.25.)

Fluid Dynamics
Proceedings of Symposia in Applied Mathematics, Volume IV

Fourteen papers by recognized authorities are presented which provide among other topics, significant contributions on the statistical theory of turbulence and the mathematical theory of supersonic and transonic flow. The subject of incompressible flow is represented by articles on propeller theory, numerical methods, viscous flow, and the method of singularities. There are also treatments of shock waves and gravity waves. (American Mathematical Society. McGraw-Hill Book Company, Inc., 330 West 42nd St., New York 36, N.Y., 1953. 186 pp., $7.)

Formulaire Du Béton Armé

An extensive collection of formulas, graphs, and working scales for the design of reinforced-concrete structural elements by R. Chambaud and P. Lebelle. The interspersed descriptive text material demonstrates all aspects of the use of the data furnished. A separate chapter deals specifically with elasto-plastic deflection. Vols. II and III are to cover strength of materials in general with emphasis on reinforced concrete, and the broad subject of reinforced-concrete structures. (Documentation Technique du Batiment et des Travaux Publics, Paris, 1953. 442 pp., Ffrs 3800.)

Handbuch Fur Stahlbetonbau
Volume IV, Part 1: Die Bodenphysikalischen Grundlagen, Stützmauern

The first chapter of this section of the Handbook for Reinforced Concrete Construction by Otto Mund provides a compact summary of modern soil mechanics. The remainder of the book presents a detailed treatment of the theory of soil pressure and the derivation of the method developed by the author for the direct determination of specific soil pressure which allows easy determination of pressure distribution for retaining walls, abutments, deep foundations, etc. Practical examples are given. (Wilhelm Ernst & Sohn, Berlin, fifth edition, 1953. 204 pp., D.M. 27.)

Heating, Ventilating, Air Conditioning Guide—1953

The fifty-one chapters of this standard reference work cover a wide range of topics: Fundamentals of thermodynamics; the physiological bases of heating and air-conditioning; calculation of heating and cooling loads of enclosed spaces; descriptions of systems and apparatus such as steam heating, panel heating, electric heating, refrigeration, and drying systems. It also includes instrumentation, pertinent codes and standards, a glossary of terms, and lists of abbreviations and symbols. (American Society of Heating and Ventilating Engineers, 62 Worth St., New York 13, N.Y., volume 31, 1953. 1560 pp., $7.50.)

History of Strength of Materials

Based on Professor Stephen P. Timoshenko's lectures on engineering mechanics, this book traces the development of the science of strength of materials from Archimedes to the present. Brief biographies of workers in the field are included; and the relation of progress in the science to industrial development and engineering education is considered. Some discussion of the history of the theory of elasticity and the theory of structures is also included. (McGraw Hill Book Company, Inc., 330 West 42nd St., New York 36, N.Y., 1953. 452 pp., $10.)

Industrial Wastes

This monograph—American Chemical Society Monograph Series, No. 118—discusses the waste treatment problem in general, principles of stream pollution and self-purification, and disposal problems of the following industries: food processing; tanning, fat processing, and laundry soap; textile dyeing and finishing; pulp and paper; acids and explosives; steel pickling; plating; coal mining. Also considered are water disposal problems of the petroleum industry and treatment of liquid radioactive wastes. References are given at the end of each chapter. Edited by Willem Rudolfs. (Reinhold Publishing Corp., 330 West 42nd St., New York 36, N.Y., 1953. 497 pp., $9.50.)

Manual on Industrial Water

Primarily a reference manual for those engaged in industrial operations using water, this book, Special Technical Publications No. 148, is also suitable for classroom use. It discusses uses of water and problems of supply; composition, sampling, and analysis of industrial water; water-formed deposits; and the reaction and corrosion products of water. The appendix contains all ASTM water standards and test methods. (American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa., 1953. 336 pp., $4.25.)

A Manual of Engineering Drawing for Students and Draftsmen

This new edition, by Thomas E. French and Charles J. Vierck, has been rearranged into four basic divisions: Fundamentals of shape description, including pictorial sketching, perspective, and intersections; size descriptions, covering dimensioning and the relationship between the drawings and the shop; discussion of basic machine elements; and the section on working drawings, including related specialties—architectural, structural, map, and topographic drawing. The usual information on lettering, the selection and use of instruments, and the making of charts and graphs are included, as are brief glossaries of pertinent terms. (McGraw-Hill Book Company, Inc., 330 West 42nd St., New York 36, N.Y., eighth edition, 1953. 715 pp., $8.)

Road User Benefit Analyses for Highway Improvements
Part I. Passenger Cars in Rural Areas

This report proposes a method for analyzing benefits derived from highway improvements which will aid in choosing the most economical location or design of a single improvement. Principal factors considered are costs of construction and improvement, costs of maintenance and operation, direct benefits to users from reduced vehicle operation costs and time saved, and benefits from increased comforts and convenience. Formulas, examples, and numerous details are included. (American Association of State Highway Officials, 917 National Press Building, Washington 4, D.C., 1952. 137 pp., $2.)

Materials Handling

This book, by John R. Turner, is intended both as a college text and a guide for the experienced handling engineer. Particular attention is paid to the organizational, cost, and managerial aspects of handling methods and equipment. Separate sections are devoted to packaging, the analysis of handling problems, the organization of handling within the company, and such special problems as machine operations, air cargo handling, and the handling of bulk materials. In addition there is a list of selected sources of information. (McGraw-Hill Book Company, Inc., 330 West 42nd St., New York 36, N.Y., 1953. 591 pp., $8.)

Symposium on Fatigue with Emphasis on Statistical Approach-II

The four papers in this publication (Special Technical Publication No. 137) deal respectively with fatigue properties of steel forgings, fatigue properties and the influence of metallurgical factors, the effect of understressing on fatigue strength, and fatigue properties of large specimens. (American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa., 1953, 91 pp., $2.)

Simplified Drafting Practice. A Modern Approach to Industrial Drafting

The result of a study of drafting practices in the General Electric Company, this book, by W. L. Healy and A. H. Rau, describes practices and routines designed to reduce the time and effort required to make drawings. Practices recommended include simplification of delineation, elimination of non-essentials, extensive use of freehand drawing, and the use of mechanical aids such as drafting machines, typewriters, and computing devices. Contrasting examples of conventional and simplified drawings are presented to illustrate the economies resulting from adoption of the principles discussed. (John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N.Y., 1953. 156 pp., $5.)

Standard Specifications for Highway Bridges

This book serves as a guide for the preparation of state specifications and as a reference work for bridge engineers. Containing revisions to specifications made since the previous (1949) edition, it conforms to the latest developments in the profession of bridge engineering and to current practices in bridge design. An extensive, detailed index provides a quick approach to any specific topic. (American Association of State Highway Officials, 917 National Press Building, Washington 4, D.C., sixth edition, 1953. 328 pp., $4.)

New Publications

Paving Mixtures. Studies of bituminous paving mixtures conducted at the Iowa Engineering Experiment Station and reported by Ting Ye Chu have been published as Station Bulletin 175. Free copies may be obtained from the Iowa Engineering Experiment Station, Iowa State College, Ames, Iowa.

Parshall Flumes. To meet the continuing demand for information on the construction and operation of Parshall measuring flumes, the Office of Information of Colorado A. & M. College has reprinted Bulletin 386, *Parshall Flumes of Large Size*. Free copies may be obtained from the Division of Irrigation, Soil Conservation Service, Colorado A. & M. College, Fort Collins, Colo.

Structural Research. A simple, rapid method of determining the maximum bending stress, deflection, and the end rotations for homogeneous beams of constant width and varying depth, such as are used in current timber roof framing members, is made available by the authors—S. M. Cotten and C. Y. Lau—in a six-page mimeographed publication. The method and tabular functions presented eliminate the laborious and time-consuming "moment-area" calculations or their equivalent, usually required for the solution of such problems, and give the desired answers in a fraction of the usual time. Copies of the paper, priced at 50 cents, are available from Christopher Y. Lau, 351 Santa Clara, Oakland 10, Calif.

Hydraulic Research. Availability of a recent Waterways Experiment Station publication, Technical Memorandum No. 3–357, entitled *The Unified Soil Classification System*, is announced by the Army Corps of Engineers. The report includes two appendixes—Appendix A, "Characteristics of Soil Groups Pertaining to Embankments and Foundation," and Appendix B, "Characteristics of Soil Groups Pertaining to Roads and Airfields." The report sells for $1, and inquiries should be addressed to the Waterways Experiment Station, Vicksburg, Miss.

Structural Drafting. The recently announced Volume 2 in the AISC series on *Structural Shop Drafting* is suitable for use as a text in the second year of a course in the field, or as a companion reference work to Volume 1, for courses in structural design and for design office practice. In addition to reviewing drafting room methods and procedures, the volume acquaints the student with aspects of detailing peculiar to the fillet-welded fabrication of beam-and-column work and explains the use of many typical standard forms used in fabricating shapes. Copies, priced at $3, may be ordered from the American Institute of Steel Construction, 101 Park Avenue, New York 17, N.Y.

Fontana Dam. Studies undertaken and the conclusions derived from observation of temperatures, pressures, stresses, strains, and deflections of Fontana Dam are reported by the Tennessee Valley Authority in its Technical Monograph No. 69, entitled *Measurements of the Structural Behavior at Fontana Dam*. Fontana Dam is the largest TVA structure on headwater tributaries of the Tennessee River. The 332-page publication sells for $4.75, upon application to the Treasurer, Tennessee Valley Authority, Knoxville, Tenn.

Water Resources. Issuance of three more bulletins on the water resources of Virginia—based on stream-flow date for the years, 1942–1950—is announced by the Division of Water Resources of the State Department of Conservation and Development. Bulletin No. 13 covers the James River Basin; Bulletin No. 14, the Chowan and Roanoke River Basins; and Bulletin No. 15, the New, Big Sandy, and Tennessee River Basins. They are available upon request to the Division of Water Resources, Virginia Department of Conservation and Development, P. O. Box 1338, University Station, Charlottesville, Va.

Flood Control. *Methods and Problems of Flood Control in Asia and the Far East* is the title of the second publication in the Flood Control Series prepared by the Bureau of Flood Control of the United Nations Economic Commission for Asia and the Far East and designated United Nations Publications 1951, 11, F. 5. Section I gives a comprehensive review of the flood control methods employed in different countries of the region, and Section II discusses the problems arising with particular reference to the river characteristics and special conditions encountered in the area. Copies are available in either French or English for $1.15. Sales agent in the United States is the International Documents Service, Columbia University Press, 2960 Broadway, New York 27, N.Y.

Highway Safety. Groups interested in attacking the traffic accident problem at local level will be aided by a free brochure recently made available by the Accident Prevention Department, Association of Casualty and Surety Companies, 60 John Street, New York 38, N.Y. The booklet, which is called *How to Attack the Traffic Accident Problem in Your Community*, explains where local safety units can obtain specific information on various phases of the traffic problem. Staff members of public support organizations may apply for free copies.

Atomic Shelters. Some of the conclusions to be drawn from the March 17 atomic test at Yucca Flats, Nev., are published by the Atomic Test Operations staff of the Federal Civil Defense Administration in a preliminary report entitled *Operation Doorstep*. FCDA concludes that persons in underground test shelters alongside demolished structures would probably be unharmed and that they would be reaonably safe in shelters inside the basement of such a structure. The reasons for this conclusion are given in detail in the illustrated report, which may be purchased for 25 cents from the Superintendent of Documents, Washington 25, D.C.

Lumber. An informative booklet on laminated lumber, developed from a symposium presented at the annual meeting of the Southern Pine Association in April, has been issued by the Association. The 36-page booklet, which is called *The Procedure, Equipment and Material Requirements for Laminating Lumber*, may be obtained from the Southern Pine Association, Box 1170, New Orleans, La. Free

copies of a 20-page booklet that explains seasoning and the benefits of dry lumber and is entitled *Build Better with Dry Lumber*, is also available from the same organization.

Welding. The Bureau of Reclamation announces the availability of a new pocket-size *Welding Manual*, intended primarily for engineers and inspectors concerned with the design, construction, inspection, and testing of its welded pressure vessels, pipes, and structures. The 208-page publication contains essential information for use in the construction of steel pipes, tanks, hydraulic machinery, bridges, buildings, and supports. The price is $1.75 and orders may be sent to the Superintendent of Documents, Washington 25, D.C., or to the Bureau's Supply Field Division, 841 Denver Federal Center, Denver, Colo.

Coastal Engineering. Basic design data and procedures presented at the Third Conference on Coastal Engineering are given in the conference proceedings, issued by the Council on Wave Research of the Engineering Foundation and available from the Council, 245 Hesse Hall, University of California, Berkeley 4, Calif. The price is $4.50 plus a 3 percent sales tax for delivery in California. Copies of the proceedings of the first and second conferences are also available at $4.50 and $4.75, respectively.

Soil Studies. In its recently issued Technical Development Report No. 194 the Technical Development and Evaluation Center of the Civil Aeronautics Administration discusses a nuclear method of measuring soil moisture and describes the construction, method of operation, and operational characteristics of present models of probe-type nuclear meters for measuring moisture and density. The studies were undertaken jointly with Cornell University. Authors of the report are Paul F. Carlton, of the Center's Airport Division, and D. J. Belcher, T. R. Cuykendall, and H. S. Sack, of Cornell. Inquiries should be sent to the Technical Development and Evaluation Center, Indianapolis, Ind.

Housing Research. Studies of shrinkage of concrete blocks, with recommendations for dealing with the problem, have been made available by the Housing and Home Finance Agency as Housing Research Paper No. 25 under the title, *Relation of Shrinkage to Moisture Content in Concrete Masonry Units*. The publication may be purchased from the Superintendent of Documents, Washington 25, D.C., for 20 cents.

Pollution Control. The unprecedented growth of industry, together with our expanding cities, has burdened many of our rivers beyond their capacity to carry away waste. The seriousness of the situation, in its effect on the health and general welfare of people and industry alike, is the subject of a pamphlet, *Washing Our Water*, published by the Public Affairs Committee of New York City. Copies are 25 cents, and requests should be sent to the Public Affairs Committee, 22 East 38th Street, New York 16, N.Y.

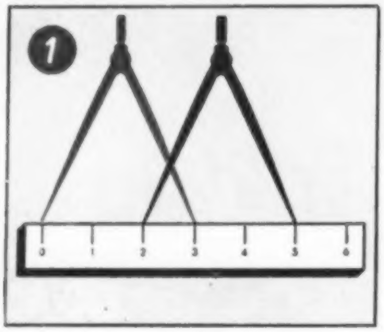
Soils Testing. Three new symposiums in the field of soil research are being made available by the American Society for Testing Materials. They are *Symposium on the Use of Radioisotopes in Soil Mechanics*, which sells for $1.25; *Symposium on Direct Shear Testing of Soils*, priced at $2; and *Symposium on Exchange Phenomena in Soils*, which is $1.75. Requests should be addressed to the American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pa.

Contract Terminology. To reduce misinterpretations and disagreements over contract language, the Society for Advancement of Management has issued a 33-page *Glossary of Terms Used in Methods, Time Study and Wage Incentives*. Called an authentic reference for both management and labor, the glossary will be helpful in the fields of cost accounting, time study, wage planning and administration, arbitration, methods engineering, sales planning, and personnel. It is in vestpocket format for convenience in handling. No. 104 in the series of publications issued by the Society for Advancement of Management, the publication may be obtained from the organization's offices at 75 Fifth Avenue, New York 16, N.Y. It sells for $1 a copy.

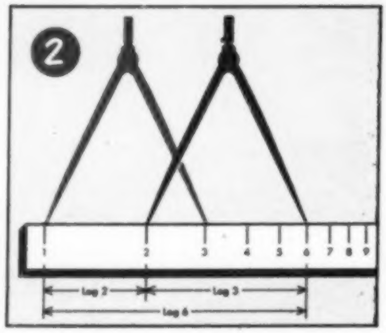
Beach Erosion. The Beach Erosion Board announces publication of its Technical Memoranda Nos. 32, 36, 38, and 40. No. 32 presents a quantitative analysis of the probable errors involved in hydrographic surveying methods, as derived from experimental surveys made at Mission Beach, Calif.;

(Continued on page 117)

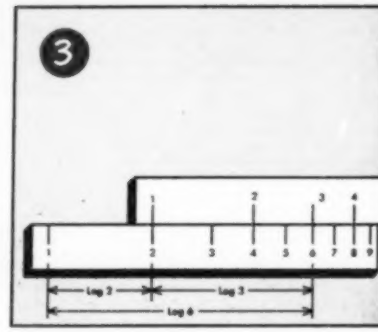
Why a Slide Rule Adds



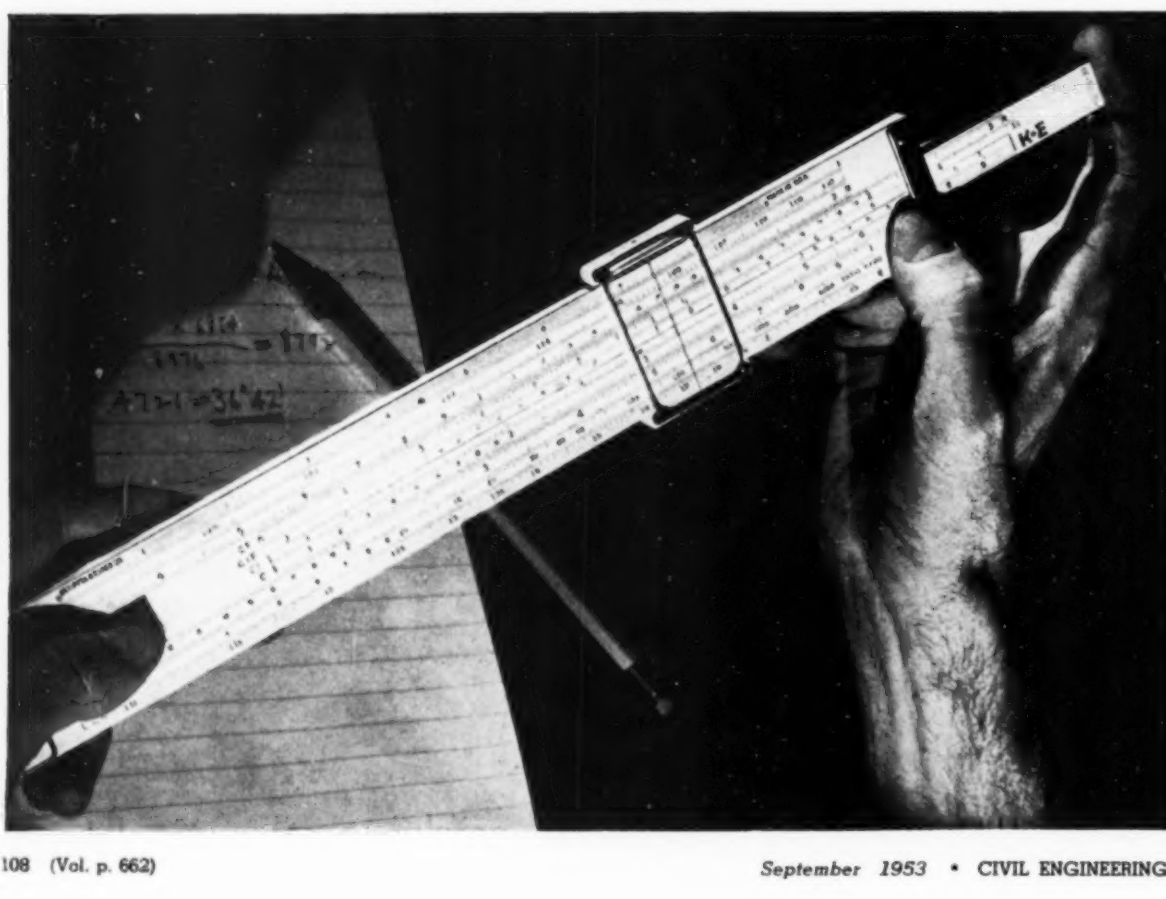
In a mechanical sense, the slide rule merely adds and subtracts quantities. How these simple operations can be performed mechanically may be seen from the illustration above, which shows the addition of 2 and 3 by means of a pair of dividers applied to an ordinary 6-inch rule. Even many electronic calculators work basically on this principle.



With a different system of calibrations on the scale, if appropriate meanings are assigned to them, more difficult problems may be solved in the same way. An example of this is seen above where a pair of dividers is shown adding 2 and 3 on a logarithmic scale and obtaining the answer 6. Advantage is taken of the fact that the multiplication of numbers may be accomplished by the addition of their logarithms.



A handier method, which begins to approach the usefulness of a slide rule, is to place two similar logarithmic scales together. Seen above is the simple setting in which 2 is shown being multiplied by 3. Observing the illustration it can be seen that the same setting also multiplies 2 by 2 and 4. Without changing the setting, the device shows the corresponding operations in division.



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Men Available

Hydraulics Engineer, J.M. ASCE; 30, married; B.S. in C.E.; B.S. in Meteorology; M.S. in C.E.; registered professional civil engineer; two years' as state drainage engineer; 1 year with consulting engineering firm. Desires research or teaching position in hydraulics and hydrology. C-876.

Civil Engineer, J.M.ASCE; 30; single; B.S. in C.E.; registered in Oregon; two years' experience on highways and airfields; 1 year on design and construction of earthfill dams, in concrete control and soil mechanics; two years teaching surveying and use of explosives with the U. S. Corps of Engineers. Good at public relations. C-877-537-A-5-San Francisco.

Civil Engineer; A.M. ASCE; 45; married; Maine and Massachusetts' registration; with experience in design and rehabilitation of public works and coordinating, directing and reviewing construction projects and installation and maintenance of utilities. Interested in career job within continental United States. C-878.

Civil Engineer; J.M. ASCE; 30; married; veteran; B.S.C.E., 1950, graduate evening courses, industrial engineering; 3 years' tool and die experience; 3 summers' construction surveying; 1 year application and sales of pumps and diesel generators; 2 years' aircraft structural engineer, all around administrative experience; seeks management or estimator position with small company in Westchester, Manhattan or northern New Jersey. C-879.

Design and Construction Engineer; J.M. ASCE; 29; married; B.S.C.E., 1948, registered; design, specifications, layout, inspection industrial buildings, water, sewers, piping, streets; steel erection and welding, plate and structural. Knowledge of mechanical and electrical fundamentals. Desires career opportunity in plant engineering or industrial construction. Location, within United States. C-880-537-A-8-San Francisco.

Structural Engineer; J. M. ASCE; B.C.E. (magna cum laude) and master of applied mechanics; age 29; 9 years' research experience in elastic stability, plates and shells, aircraft stress analysis, sandwich theory and column creep. Supervisory and high-speed digital computing experience. Seeks position in research, applied mechancis, applied mathematics, stress analysis or consulting. C-881.

Engineer; J.M. ASCE; B.S. in C.E.; 27; single; experience in field construction, design and construction administration; graduate work in engineering management and business. Desires responsible foreign or domestic job entailing engineering and work with people. C-882.

Civil Engineer; J.M. ASCE; 31; married; B.S. in C.E., M.S. in C.E., majoring in hydraulics-sanitary; 1½ years' teaching surveying, photogrammetry, strength of materials; 4 years' experience in hydraulic model studies; soon to be released from active military duty consisting of general civil engineering research administration; prefers applied research or design. Location, east of Mississippi. Will consider other attractive offers. C-883.

Positions Available

Construction Estimator and Cost Control Man, thoroughly experienced in quantity take-offs and estimating and with a successful performance record in competitive bidding. Cost control experience required. Background in power plant work, process piping and general industrial construction absolutely essential. Should have been successful as a chief estimator. Salary, $8,000–$10,000 a year. Location, Pennsylvania. Y-8409.

Civil Engineers. (a) Engineers experienced in sewer design and sewer construction work. Must be registered in Ohio or be able to obtain registration. (b) Structural Designers who have 2 or 3 years' experience on bridge work. Positions are with a municipality in Ohio. Y-8505.

Structural Designer, engineering degree and a minimum of 6 years' experience on reinforced concrete. Must be professional engineer or qualified. Permanent position. Salary open. Apply by letter giving education, experience, references, salary requirements and availability. Location, Ohio. Y-8672(b).

Sanitary Engineer, 35–40, with experience in water supply and sewerage. Must be qualified for design, specification writing, supervision and client contacts. Long established consulting engineering organization. Location, Middle Atlantic State. Y-8707.

Construction Superintendent to take complete charge of heavy construction and to supervise from 200–2000 men on large building and concrete wall construction. Salary, $10,000–$12,000 a year. Location, Washington State. Y-8735.

Civil Engineer, 30–40, graduate, experienced in construction and surveying work. Supervisory experience covering construction on buildings, structures, foundations relative to utility properties and land surveying related to easements and rights-of-way essential. Experience and ability in design and layout required. Position is for electric utility. Salary open. Location, Midwest. Y-8762.

Graduate Assistantships in civil engineering department. Will spend half of time in graduate work and the remainder on a research project. Positions open in the fields of structural engineering, sanitary engineering, fluid mechanics or hydraulic engineering. Salary, $1,305 for 9 months. Should be able to secure master's degree in 2 years. Location, New England. Y-8771.

Designer with structural experience and knowledge of stresses and strains. Engineering degree or equivalent in practical experience. At least 5 years' structural design experience. Company manufactures electrical distribution equipment for residential, public utility, industrial and defense applications including safety switches, circuit breakers, meter service and other related items such as aerial crows nest ladders and reactors. Will prepare general layout drawings, detail drawings, and bills of materials for aerial crows nest ladders and reactors. Make any mathematical or graphical calculations necessary to establish the design and necessary tolerances, etc. Salary, $5,588–$6,682 a year. Location, New York Metropolitan area. Y-8786.

Project Manager or Construction Superintendent, about 50, for assignment on the construction of an oil refinery. Must have considerable experience in this field, having served as a project superintendent on a refinery construction job. Salary, $14,400–$16,800 a year. Location, Peru. Y-8818(*a*).

Junior Ceramic or Civil Engineer for office and later field engineering work in cement industry. Salary, $4,080 a year. Location, New York, N.Y. Y-8871.

Sales Engineer, young, civil, mechanical or chemical graduate, with about three to five years' general experience. Will assist a department manager in the field of public works, including design, engineering, sales and construction. Should be willing to travel. Company is engaged in the design and construction of municipal refuse incinerator plants. Salary open. Location, New York, N.Y. Y-8881.

Construction Superintendent, A.E. or C.E. graduate, with minimum of 10 years' experience in industrial and commercial construction. Will take complete charge of field activities of small, long established general contractors. Give full particulars in application. Salary open. Location, southeastern Pennsylvania. Y-8897.

Bridge Design Engineers and Draftsmen experienced in highway bridge design and preparation of contract drawings for expressway work. Furnish full information regarding education, experience, age, references and salary required. Location, Maryland. Y-8908.

Sales Engineers with experience in the construction equipment machinery field, to sell to contractors and industrial companies. Salary, $3,900 a year plus commission. Company supplies car. Territories, one for Philadelphia area; one for southern New Jersey. Y-8943.

Construction Superintendent, resident engineer for contracting firm doing heavy construction on housing. Salary, $7,500–$10,000 a year. Location, eastern Pennsylvania. Y-8944.

Port Engineer with 5 to 10 years' experience in the design and construction of port facilities in addition to supervisory operating experience. Salary, $7,770–$9,077 a year. Location, Pennsylvania. Y-8952.

Construction Engineer with a minimum of 10 years' experience in the design and construction of buildings in the field. Any hospital experience desirable. Will train Nationals on job. Salary, $12,000 in American currency plus living quarters and living allowances paid in local currency. Duration 3 years. No income tax. Location, Burma. F-8991.

Cost Engineer or Estimator, 35–45, engineering graduate with at least 10 years' practical experience as a cost engineer, preferably on hydroelectric projects. Will establish methods, train and supervise a small staff in the field to report and analyze the cost of each phase of a job and the estimated cost to complete, to report the physical completion of each phase of a job, and to assist in the preparation of estimates, budgets, or other work of a similar nature. Some traveling. Location, Brazil. F-8999.

Commissioner of Buildings and Conservation, graduate civil or architectural engineer, with broad experience in general building work. Must have broad civic interest, administrative ability in finance, builoing, or related endeavor. Proven record as administrator; keen interest in problems involved in administering building and housing codes and conserving residential neighborhoods. Must have ability to adopt modern and effective techniques to achieve these ends. Salary open. Location, Middlewest. C-1113.

Instructor or Assistant Professor, M.S. in C.E. desired. At least one years' experience in field of design or teaching. Will teach general civil engineering courses with emphasis on structural engineering. To start in September 1953. Salary, $3,500–$5,500 for 9 months. Location, Michigan. C-1118(*b*).

Chief Estimator, with several years' experience and capable of directing estimating department of a building contractor. Location, Texas. C-1161.

Instructors, graduate civil and mechanical engineers, with good scholastic records, to teach engineering drawing and descriptive geometry; to start in September 1953; also an opening for February 1954. Salary, to $4,000 for 9 months. Location, Illinois. C-1170.

Non-ASCE Meetings

Alaskan Science Conference. The Southeastern branch of The Alaska Division of the American Association for the Advancement of Science will act as host to the fourth Alaskan Science Conference at Juneau, September 28–October 2. Special conference rates are being offered by the Gastineau and Baranof hotels.

American Concrete Pressure Pipe Association. The fifth annual convention and meeting of the American Concrete Pressure Pipe Association will be held at the Ponte Vedra Inn, Ponte Vedra, Fla., October 8–10.

American Welding Society. The American Welding Society will hold its fall meeting at the Hotel Cleveland, Cleveland, Ohio, the week of October 18.

Concrete Reinforcing Steel Institute. Headquarters for the semi-annual meeting of the Concrete Reinforcing Steel Institute, will be the Greenbrier Hotel, White Sulphur Springs, W. Va., October 12–17.

Fourth Conference on Coastal Engineering. The Council on Wave Research of the Engineering Foundation at the University of California is sponsoring the Fourth Conference on Coastal Engineering, which will meet this year at the Del Prado Hotel, 5307 South Hyde Park Boulevard, Chicago, Ill. Inquiries should be directed to the Secretary of the Council on Wave Research, Engineering Foundation, 245 Hesse Hall, University of California, Berkeley, Calif.

National Conference on Industrial Hydraulics. Host to the ninth National Conference on Industrial Hydraulics, to be held at the Hotel Sheraton, Chicago, Ill., October 8 and 9, will be the Illinois Institute of Technology. Sponsoring organizations include the local sections of the Founder Societies.

National Instrument Conference and Exhibit. The Eighth National Instrument Conference and Exhibit, sponsored by the Instrument Society of America, will be held at the Morrison and Sherman hotels, Chicago, Ill., September 21–25.

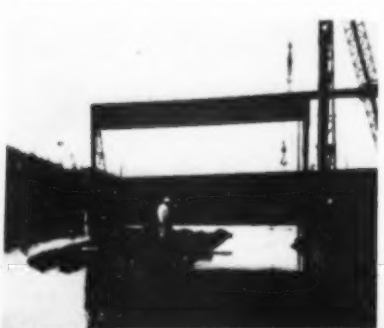
Joint ASEE-ECPD Meeting. A joint meeting of the American Society for Engineering Education and the Engineers Council for Professional Development will be held at the Hotel Statler, New York, N.Y., October 14–17.

Structural Engineers Association of California. Headquarters for the annual convention of the Structural Engineers Association of California will be the Ahwahnee Hotel, Yosemite Valley, Calif., Oct. 8–10.

Wisconsin Society of Professional Engineers. The seventh annual summer meeting of the Wisconsin Society of Professional Engineers will take place at Elkhart Lake, Wis., September 18 and 19.

Solution to problem on page 45

It was decided to use a log raft just as the early pioneers did. One end of the girder was placed on the raft and, with one truck



crane holding the other end, the girder was floated across.

Even this "simple" method used by the pioneers required a little fancy mathematical calculation. It was decided that 1,035 cu ft of logs were needed to do the job. The Booth-Kelly lumber people loaned the erection crew five logs for a raft. With this raft, each of the two steel girder ends was floated across to the far side of the stream, and the two cranes easily lifted them into place.

The 80 tons of structural steel required for the runway was fabricated at Bethlehem Pacific's Seattle fabricating works.

Positions Announced

City of Milwaukee. Urgent need for structural design engineers to fill several positions as Civil Engineer III with annual salaries of $5,910 to $6,534 and as Civil Engineer II at $5,098 to $5,722 is announced by the City Service Commission of Milwaukee. The work will consist of structural design on both fixed and bascule bridges. Information—together with application blanks and questionnaires on training and experience—may be obtained from the City Service Commission Room 716, City Hall, Milwaukee, Wis.

Pittsburgh's Gateway Center...

(This article begins on page 46)

(Continued from page 50)

immediate use when required. With these gates in place, it is believed that Gateway Center can defy any future floods.

All substructure work was required to be of controlled concrete with a specified minimum cement content. The 28-day strength was generally 3,000 psi except for columns, where 3,500-psi concrete was called for. For the 3,500-psi concrete and for the 3,000-psi concrete exposed to water pressure, at least 6 bags of cement per cu yd were required. Elsewhere, for interior walls, slabs, and other unexposed work, 3,000-psi concrete was required to contain at least $5^{1}/_{2}$ bags of cement per cu yd. Slattery Contracting Co.–Harrison Construction were the subcontractors for all subgrade concrete work.

Precast Panels for Exterior Walls

Various types of exterior wall construction received consideration in the planning of Gateway Center. However, because of the scarcity of materials, or the preoccupation of manufacturers with special types of defense work, the choice was finally narrowed to a system of metal-faced, precast, lightweight concrete panels. This selection proved very satisfactory, as the standarization of the panels into six different shapes permitted mass production and the speedy erection of one story a day per building.

In each story of a building, there are 800 lin ft of wall, 11 ft 9 in. high, for which 252 pieces are required, varying in weight from 1,000 to 6,000 lb apiece. The panels (Fig. 5) consist of a spandrel section, mullion, three pier facings, and one corner cover. The serrated metal facing, made of stainless steel with 11 percent chrome, is 0.031 in. thick. Behind the facing is a breathing bed of porous concrete 1 in. thick for draining condensation. This is backed with reinforced perlite concrete, averaging $4^{1}/_{2}$ in. thick except for the $7^{3}/_{4}$-in. ribs at the mullions and pier covers. The panels were cast in special hinged steel forms in which the shaped metal facing was laid first.

Brackets Support Panels

Mullions are T-shaped in section, 16 in. wide, and project $2^{3}/_{4}$ in. beyond the spandrels to cover the joint. They are provided with a seat, con-

cealed by the joint, on which the spandrel panels rest. Pier covers resemble the mullions except that they are double and about 4 ft 2 in. wide to straddle the building columns. Corner covers are one piece, 4 ft 6 in. by 4 ft 6 in. Spandrel panels, 3 ft 10 in. wide by 5 ft 7 in. high, fit between the mullions or pier covers, and extend from the window head to the window stool above. Spandrels are bolted to threaded inserts cast in the back of mullions, and are supplied with the necessary fittings for attaching windows, furring, and miscellaneous fixtures.

Mullions and pier covers are in story-height lengths. They are attached to the building by U-shaped $^3/_8$-in. plate brackets field welded to the spandrel beams (Fig. 4). The brackets are provided with an angle seat for the erection of the member, and also with holes for four $4^5/_8$-in. bolts for anchoring the precast piece. All bolt heads and washers were tack-welded to prevent loosening. Brackets were shaped to clear horizontal runs of heating pipes under the windows. In some instances, where bolts and seats were impracticable, brackets were field-welded to plates cast in the precast member. All brackets were covered with lightweight concrete fireproofing after the wall was completed.

Wall Designed for 20-lb Wind Pressure

The wall was designed for a 20-lb wind pressure, in accordance with the requirements of the Pittsburgh code. Necessary bar and mesh reinforcement was provided to suit this criterion as well as shrinkage, temperature, and handling stresses. Perlite concrete was required to develop a strength of 2,000 lb with a weight not exceeding 110 psf. Full-scale tests of mullions loaded with sand bags, fire tests, and heat transmission tests were conducted to determine their properties, with completely successful results.

The steel facings for the panels were formed by United Steel Fabricators. Panels were assembled, cast, and delivered by the Cementstone Corp. and were erected by the James MacLean and F. H. Sparks Co. of Pittsburgh.

The Gateway Center Project was designed for the Equitable Life Assurance Society of the United States by a board of design which consisted of Irwin Clavan and Eggers & Higgins, architects; with Di Stasio & van Buren as structural engineers; Meyers, Strong and Jones as mechanical engineers; and Clarke, Rapuano, & Holleran as landscape architects. Starrett Bros. & Eken were the builders.

New in Education

A new graduate course in traffic engineering is announced by the Graduate Division of the New York University College of Engineering for the first semester of the 1953–1954 academic year. Primarily intended for persons holding undergraduate degrees in civil engineering, it will cover traffic engineering organizations and functions, traffic survey techniques, and the presentation and analysis of survey data with particular emphasis on traffic studies in urban areas. Additional information may be obtained from Assistant Dean, Graduate Division, College of Engineering, New York University, University Heights, New York 53, N.Y.

Mounting interest in the design and construction of prestressed concrete structures has prompted the Polytechnic Institute of Brooklyn, Brooklyn, N.Y., to introduce a course on the subject with emphasis on American practices. Starting September 24, the classes will meet 8 to 10 p.m. every Thursday evening during the fall semester under the supervision of Prof. Odd Albert. The program will include discussion of materials, fundamental theories, specifications and applications to the design of bridges and buildings, with considerable attention to solution of practical design problems.

Designed primarily to provide professional personnel working in health departments and other organizations with a working knowledge of the health hazards associated with radiation, the Public Health Service at the Environmental Health Center, Cincinnati, Ohio, is presenting a series of two-week tuition-free courses in radiological health. Sessions in the basic course will be held October 5–16; January 11–22; and May 3–14; Intermediary classes meet October 19–30; January 25–February 5; and May 17–28. Advanced courses will meet February 8–19; and a special one-week course for waterworks personnel is scheduled for 1954. A bulletin describing the 23 courses is available upon request from the Officer in Charge, Environmental Health Center, Public Health Service, Department of Health, Education and Welfare, Cincinnati, Ohio.

Utilization of solar energy will be reviewed and explored by almost thirty physical scientists and engineers engaged in the field at a symposium to be held at the University of Wisconsin, September 12–14. Subjects scheduled for discussion include solar house-heating, solar engines, storage of power, meteorology, solar energy, conversion into electricity, and retardation of frost damage. A $6,000 grant was given to the University of Wisconsin by the National Science Foundation for joint support of the conference.

In recognition of the contribution made by Earle B. Norris, dean emeritus of the school of engineering at Virginia Polytechnic Institute, the research professorship of the wood construction department has been designated the "Earle B. Norris Research Professorship." Under Dean Norris' guidance the Wood Research Laboratory at V.P.I. was developed by Dr. E. George Stern.

(*Continued from page 107*)

No. 36 gives wave characteristics at five selected stations on Lake Michigan determined by "hindcast" technique from synoptic weather charts for a three-year period, and No. 38 wave characteristics at three selected stations on Lake Ontario determined by the same method; and No. 40 presents experimental data for deep water, shallow water, and breaking waves. Free copies are available from the Beach Erosion Board, Corps of Engineers, 5201 Little Falls Road, N.W., Washington 16, D.C.

Civil Defense. A manual to acquaint the householder with the problem of providing his family with shelter against atomic attack, helping him select the type of shelter best suited to his needs, and giving him step-by-step building instructions has been made available by the Federal Civil Defense Administration. Recommended designs proved their ability to withstand atomic blast and radiation during the 1953 atomic tests at the AEC Proving Ground in Nevada. The publication is entitled *Home Shelters for Family Protection in an Atomic Attack* and identified as Manual TM 5-5. It may be obtained from the Superintendent of Documents, Washington 25, D.C., at 30 cents a copy.

Applications for Admission to ASCE, July 11–August 1

Applying for Member

Alfred Fortin Beck, Chicago, Ill.
Steven Ross Berke, Boston, Mass.
Harry Brenman, Denver, Colo.
Tsung-Wen Chen, Denver, Colo.
David Shu-Ling Chu, Denver, Colo.
Clay Thomas Colley, Red Bank, N. J.
Kenneth Joseph Cramsie, San Francisco, Calif.
Eric William Desmier, Calcutta, India.
Takeo Fukuda, Chiba City, Japan.
Ahmad Hasan, Bahawalpur, Pakistan.
Leon Dwight Holden, Allentown, Pa.
Theodore Roosevelt Lovell, Des Moines, Iowa.
Ivan Maxwell Stout, Austin, Tex.
Thurman Allen Stout, Charlestown, W. Va.
Delbert Russell Ward, San Antonio, Tex.
John Warren Weller, Detroit, Mich.
Edward George Wetzel, New York, N. Y.

Applying for Associate Member

Robert Manning Ancell, Denver, Colo.
John Alfred Ashworth, Jr., Fayettville, Ark.
Charles Lee Bunce, Santa Barbara, Calif.
Donald Edward Carlson, Honolulu, T. H.
Robert Hardin Deaderick, Cleveland, Ohio.
Bannister Luther DeBerry, San Antonio, Tex.
Orville Leo Dickinson, Los Angeles, Calif.
Robert Joseph DuPlessis, New York, N. Y.
Aziz Zaki Farag, Cairo, Egypt.
Harry Clarence Finley, Honolulu, T. H.
William Francis Garber, Los Angeles, Calif.
Paul Hegler, Los Alamos, N. Mex.
George Herrmann, New York, N. Y.
Norman Higginson, Jacksonville, Fla.
Lloyd Francis Hooper, Canyon Ferry, Mont.
Harvey Dale Johnson, Kansas City, Mo.
James Cantrill Johnson, Oklahoma City, Okla.
Wesley Russell Larsen, Urbana, Ill.
Hing Chock Lau, Pearl Harber, T. H., Honolulu.
Charles Cleveland McDonald, Fort Worth Tex.
Milford Henry Meuser, Richland, Wash.
Wallace Samuel Prescott, Cookeville, Tenn.
Norman Harold Reece, New York, N. Y.
John Carl Rowland Kansas City, Mo.
Andrew Ivan Rubinsky, Tripoli, Lebanon.
James Irby Seay, Jr., Memphis, Tenn.
John Alden Tweed, Omaha, Nebr.
Clarence Arthur Vicklund, Jusepin, Venezuela.
Warner Whitoman Wayne, Jr., Westwood, Mass.
Rex Linn White, Omaha, Nebr.

Applying for Junior Member

Donald Anker Christensen, New York, N. Y.
Hans Eberhard Fabricius Correa, Caracas, Venezuela.
Robert Dale Gilmore, Beverly Hills, Calif.
Kirby Brana Havard, Fontana, Calif.
Allan Charles Jones, Jr., Albuquerque, New Mex.
George True Kroh, Stockton, Calif.
Henry Maksoud, Iowa City, Iowa.
Hugh Bernard McFarland, Newark, N. J.
Oscar Mejia, Iowa City, Iowa.
Ibrahim Mahmoud Mostafa, Iowa City, Iowa.
Edward Richard Pershe, Harrisburg, Pa.
Richard Childs Schroter, Niles, Mich.
John Franklin Thorp, San Francisco, Calif.
Raymond Leon Williams, Speedway, Ind.

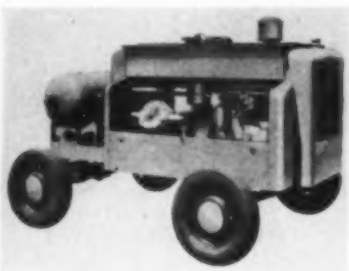
[*Applications for Junior Membership from ASCE Student Chapters are not listed.*]

EQUIPMENT, MATERIALS and METHODS

NEW DEVELOPMENTS OF INTEREST AS REPORTED BY MANUFACTURERS

Portable Compressor

A 160 CFM portable compressor, to be known as the Super Chief 160, is announced. Available in 2-wheel and 4-wheel trailer and in skid mountings, the unit is reputed to be from 200 to 1,000 lbs lighter than other compressors of the same capacity. The Model 160 Super Chief has 2 low pressure cylinders with 6 in. bore and $3^3/_4$ in. stroke; and one



Super Chief 160

high pressure cylinder with $5^1/_4$ in. bore and $3^3/_4$ in. stroke. It is offered in both gasoline and diesel-powered models. Standard features include automatic compressor-engine controls; individually-finned cylinders, separately replaceable; full force feed lubrication; cast aluminum crankcases; Multi-Port valves, electric starting; automotive type steering; full spring suspension and double, built-in full length tool boxes. The 4-wheel trailer, diesel-powered, is 115 in. long, 75 in. wide, and 70 in. high. **Davey Compressor Co., CE 9-118, Kent, Ohio**

Automatic Welding Machine

THE DEVELOPMENT of an automatic welding machine for use by large mining firms, aggregate crushing companies, steel mills, government agencies, general job shops and the general construction field has been announced. The unit, called the Model 650 Leader automatic welding machine, is ruggedly built for heavy use. It is tailored to the needs of the industry and features an all new consolidated finger tip control panel; dual, adjustable, spring-braked rod-reel holders; motorized, acme-powered, 8 ft cross arm with side beam carriage; a motorized pedestal which is also acme-powered and has a 6 ft push-button-controlled lift and can be rotated through 360 deg. It also has a heavy-duty automatic welding head complete with assorted contact tips, tip extension, adjustable rod feed rollers; automatic and manual bead lapping control; and a carriage equipped with angling device for head, rectifier D.C. source of welding current. **Leader Welding & Manufacturing Co., CE 9-118, 2418 Sixth St., Berkeley 2, Calif.**

Trackliner

THE NATIONAL OPTICAL TRACKLINER has recently been improved. This instrument is essentially a short telescope mounted on a vertical staff which has a two-legged shoe that is set on the top of the rail and clamped to it with a steel spring, while a side tripod leg holds the instrument in an upright position. The improvements include sealed-in ball bearing telescope axis and centers which are dust proof and permanently lubricated, a telescope of the internal-focusing type with coated lenses and an extension-type tripod that permits quick fastening and removal from the rail. Generally a point is located at the end of a curve or on a tangent that is on line. The instrument is set on this location with a target placed ahead in the direction of the track to be lined. If center stakes are used the target is usually set at one of these points or if center stakes are not available, a spot is selected as being correct. After setting up the instrument and target, the objective end of the telescope

Eliminates Guess Work

is lowered and focused on the gauge side of the rail ahead, as trackliner is optically centered over the gauge side of the rail and by use of hand signals agreed upon with the men beforehand, they are instructed to throw the track with lining bars. This is about the same procedure that is used in eye lining except in using an instrument it is never necessary to back the men up more than a few feet to touch up a quarter that may stick in long rails and heavy ballast. The man that does the hollering for the liners usually locates the center of the spot that is to be thrown by sliding a lining bar or a stick along the gauge line of the rail to be lined until signaled by the instrument operator. All the guess work is eliminated that is so often encountered by eye liners and true alignment is accomplished with a minimum amount of effort. **National Blue Print Co., CE 9-118, Chicago Union Station Bldg., 517 West Adams St., Chicago 6, Ill.**

Front End Loader

EXTRA YARDAGE, higher daily output, faster cycles, less breakage, and smoother operation are reported by users of the Model 15, $1^1/_2$ cu yd Speedall front end loader with Torque Convertor. Speedall equipped with Torque Convertor now provides inch by inch control of foot accelerator without shifting speeds or slipping clutch. This makes it simple for

Model 15

operators with minimum experience to produce extra yardage over conventional gear shift loader operations. Among the advantages offered are: extra power for tough going and smoother, faster acceleration throughout the entire loading cycle regardless of the load size. The usual damaging effects of shocks, jars and jolts on operating mechanisms are virtually eliminated. The engine operates at maximum efficiency at all times with full engine power for full loads and just enough power for light loads because of automatic power selection for the load being handled. Further, the engine cannot be stalled, thus eliminating slowdowns while waiting for the engine to pick up speed. With a 15 ft 9 in. height over closed bucket, fully raised, and a reach of 3 ft 7 in. at maximum dumping clearance, the Speedall is unique in its capacity, maneuverability and versatility in the front end loader field. **Pettibone Mulliken Corporation, CE 9-118, 4700 West Division St., Chicago 51, Ill.**

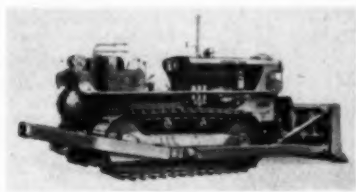
Versatile Drill

THE MODEL B-52 Mobile drill features 500 ft drilling depth, one man operation, skid or trailer mounting with independent power plant or P.T.O. operation. It is designed to fit Ford, International, Willys, Chevrolet or Dodge heavy duty trucks. The B-52 features a dual hydraulic cylinder which assures fast, positive feed with 5, 6 or 7 foot stroke and 12,000 lbs pressure. It combines in one unit three types of drilling: auger, rotary core, and precussion. **Mobile Drilling Inc., CE 9-118, 960 North Pennsylvania St., Indianapolis, Ind.**

Equipment, Materials & Methods (Continued)

Pusher Tractor

A D8 PUSHER tractor, adapted and equipped specifically for pusher loading work, has been announced. The machine is a modified version of the D8 tractor. The complete pusher package—150 drawbar-horsepower tractor, No. 8S bulldozer and No. 25 cable control—has been developed to meet an extensive customer demand for a tractor capable of heap loading large scrapers. The D8 has four special features: a more powerful engine; weight increased to 50,025 lbs for better pusher balance and increased traction; bulldozer and cable controls for inlined pushing action and clean up of cut; and new transmission for the most suitable pushing speed and oil-type clutches for longer life. One of the outstanding features of the D8 pusher tractor is the tandem pusher frame attachment, developed after careful observation of earth moving contractors who use pusher tractors in tandem for difficult loading conditions. By permitting the transfer of power from one tractor to another through the track roller frame, the highly destructive stresses imposed on the lead tractor's final drive is avoided. **Caterpillar Tractor Co., CE 9-119, Peoria 8, Ill.**



Features a Tandem Pusher Frame Attachment

Chain Saw

EXCEPTIONAL POWER, faster cutting, lightweight and low maintenance are among the big features incorporated in the 30 lb, 5.5 hp gasoline chain saw, Model 5-30. Designed for the man who wants power—extra, dependable power—the Model 5-30 purrs through a 20 in. tree in as little as twenty sec., brings down timber 4 ft or 5 ft or more in diameter quickly and easily. The company claims that because it gives more proven power per lb than any other saw, the Model 5-30 is the ideal saw for professional woodcutting, land clearing, pruning or timber ripping. Because of its light and perfectly balanced weight, the saw is extremely easy to handle; and it cuts in any position—up, down or upside down; on all types of cuts—felling, bucking, boring, notching, trimming or undercutting. In addition to its all-angle carburetion, the saw features: automatic clutch, positive chain lubrication, quick-starting, weather-proof performance, rugged and simple design, and money-saving dependability. **Homelite Corporation, CE 9-119, 111 Riverdale Ave., Port Chester, N. Y.**

Equipment, Materials & Methods (Continued)

Self-Loading Truck Crane

A LINE of unusual and very versatile loaders, adaptable for use on any truck, has recently been announced. Available in a wide range of capacities, from $^1/_2$ to 2 ton lifts, the unit converts a truck into a self-loading truck-crane that speeds scores of materials handling jobs. The loaders are particularly adaptable for use in logging, mining, oil, construction and utility operations. They are also a profitable investment for small truck operators desiring a means of lifting, loading and handling with one piece of equipment. The crane unit mounts directly behind the cab and occupies only from 16 in. to 18 in. of space. There is no reduction in truck body or platform capacity and the entire load-carrying capacity of the bed is retained. Installation is simple as there is no need to cut or alter the truck body—it is simply moved back on the frame. The loader is made in two models; one with an elevating mast, and one with a "fold-over" superstructure. In the latter model, the top portion of the structure can be folded down for traveling, and for bridge and door clearance. Standard loaders will pick up loads from any radius up to 16 ft. On the "fold-over" models, the boom swings 170 deg, on the elevating mast models the swing is a full 360 deg. Power for hoisting is supplied by the truck engine through a power take-off. The unique type of winch used employs standard automotive parts for simplicity of operation and service. Powerful and quick-acting, the winch provides smooth operation, with no shock to engine or transmission. The winch clutch, brake and transmission controls, together with the boom brake, are conveniently grouped and mounted for ease of operation. The loaders are finding many uses where speed of handling and convenience of loading are important, as loading can be done anywhere a truck can be driven. **Ray-Lind Mfg. Co., CE 9-120, Iron River, Mich.**

Portable Asphalt Plant

THE MODEL PM 215 Patchmobile is designed to produce accurately proportioned hot-patch material on-the-job for maintaining streets, highways, airport runways, parking areas, railroad crossings, and for building driveways, sidewalks, and for mixing mastic material for floors and bridge decks. The Patchmobile PM 215 features a rotary dryer, asphalt tank, pug-mill, power asphalt pump with spray attachment, volumetric asphalt measuring device, and asphalt tool-heating compartment, all in one packaged unit. It requires no other piece of equipment on the job, except a dump truck for towing (which can also be used to haul sand and gravel for the mix). No manual handling of aggregate and asphalt is necessary during the entire process of mixing the material in the PM 215 Patchmobile. The aggregate is shoveled from

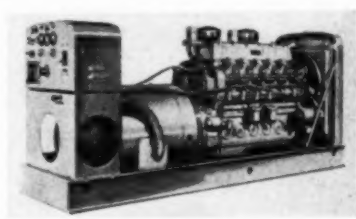
(continued on next page)

Equipment, Materials & Methods (Continued)

the dump truck into the charging chute of the rotary dryer. As the dryer rotates, the material is conveyed by means of flights through a blast of flame from the dryer burner to the discharge chute and into a batching hopper located directly above the pug-mill. As the hot, dry aggregate is released into the pug-mill, the correct proportion of hot asphalt from a volumetric measuring reservoir is discharged into the pug-mill through a spray bar. This eliminates handling of the hot asphalt by buckets or ladles. As the asphalt reservoir is emptied it is immediately refilled by a power-driven asphalt spray pump, which is standard equipment on the PM 215. The aggregate and asphalt is mixed and conveyed through the pug-mill to the discharge gate where the hot, mixed material is ready to be used. **Wylie Mfg. Co., Box 7086, Zone 12, Oklahoma City, Oklahoma.**

Diesel-Electric Generating Sets

A LINE OF Diesel-electric generating sets in capacities of 20 to 75 KW has just been released. The units are powered by the P&H 2-cycle diesel engines. Among the important advantages of these engines is simpler maintenance. It is possible to replace an entire cylinder assembly in less than 40 min. P&H generating sets come with four types of controls: emergency



Model 687C

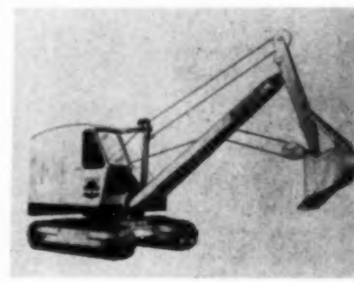
automatic, which takes over on full load the instant of regular power source failure; semi-emergency automatic, which handles partial service upon failure; electric starting, which is controlled manually with an operator distributing power at will; and remote electric starting, which can be started from any of several distant points by push button. Complete switchboards are included with both AC and DC models including, as standard equipment, all required controls. Both AC and DC models are rated for continuous duty and conform to the most rigid standards including those of the N.E.M.A. and A.I.E.E. **Diesel Div., Harnischfeger Corporation, CE 9-121, Crystal Lake, Ill.**

When Requesting Product Information Please Mention Civil Engineering

Equipment, Materials & Methods (Continued)

Crawler Shovel-Crane

THE INTRODUCTION of a $^3/_8$ yd, 5-ton rated crawler-mounted line of cranes, back hoes, draglines, shovels, clamshells, pile drivers and magnet cranes has been announced. Model designation of the new crawler is the C-35. The Model C-35 Bantam is designed with many important engineering features such as: two-speed independent travel, enabling the operator to work a front-end attachment while travelling and swinging the machine, all



Model C-35

simultaneously; undercarriage is designed with heavy-duty main frame and deep, rigid side rails; six track rollers provide even distribution of load weight over entire track assembly; drive power through chain and jaw clutches are used for each track; a "twin-swinger" drive arrangement, plus fast-acting mechanical controls and jaw clutches, enables operator to enter turns with a split-second pause and return to straight-line travel after turn without stopping. The C-35 has low ground-bearing pressures with either of the two standard size pads available—5 lbs psi with 16 in. pads, and $3^1/_2$ lbs psi with 24 in. pads. The Model C-35 equipped with 16 in. pads, has an overall width of 94 in., thus meeting highway transportation requirements without special road permits, and weight runs 15,522 lbs, including 1400 lb counterweight, but without a front-end attachment. A power boom hoist which gives power lowering as well as raising is standard equipment, at no extra cost. The full-revolving crawler shovel-crane has a 6 rpm swing speed, 175 fpm line speed, and incorporates standard Bantam features. **Schield Bantam Company, CE 9-122, Waverly, Iowa**

X-Ray Machine

A "MIDGET" INDUSTRIAL 250,000 volt x-ray machine, less than half the size and less than $^1/_4$th the weight of the conventional quarter-million-volt unit, has been perfected by General Electric's X-Ray Department. The lightweight, mobile unit, known as the Resotron 250, although capable of x-raying steel up to 3 $^1/_2$ in. in thickness, can be easily carried around in refineries, foundries, welding shops, shipyards, building and pipe line projects

(*Continued on next page*)

Equipment, Materials & Methods (Continued)

and on many other jobs where x-ray inspections are needed to control quality and safety. The unit is less than 15 in. in diameter and 44 in. long; weighs only 150 lbs, as against 1,150 for conventional units. The first major application has been made in U.S. Navy shipyards where it is used to inspect critical welded seams and stressed areas on submarines and other craft during and after construction. A feature of the unit's versatility is its protruding "snout" from which the x-rays are emitted, which makes possible the taking of "inside out" x-ray pictures. This will greatly speed up the process and reduce problems now faced in making x-rays. In setting up for the inspection of a weld joint connecting two sections of a pipe, for example, the x-ray technician can bring the x-ray unit inside the pipe and change its position for each exposure area without disturbing the pipe. He can also use it inside large castings and other areas difficult of access, or insert the snout inside a smaller casting. Operating at anywhere from 75,000 to 250,000 volts, the new unit can be used on anything from magnesium to steel. Use of the machine on light metals is also aided by the beryllium "window" of the x-ray tube, which allows the escape of softer, less penetrating x-rays from the tube. **X-Ray News Bureau, CE 9-122, General Flectric Co., 4855 Electric Ave., Milwaukee 14, Wis.**

Tractor-Drawn Scraper

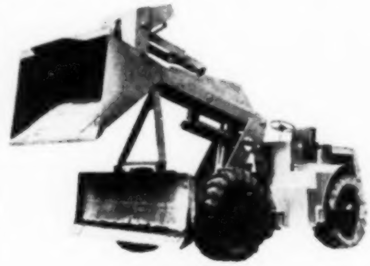
INTRODUCING AN OPEN bowl design, the company has announced production of the Model OS-152 tractor-drawn scraper, with capacities of 19.0 cu yds heaped, 15.2 cu yds struck. Extremely low gravity center for stabilized balance in all positions, high 25 in. ground clearance offering increased maneuverability, and wide 75 in. apron opening to allow unrestricted discharge of sticky materials are claimed as advanced design characteristics. Faster and easier loading results from latest application of the "boiling bowl" principle. Other features include a positive "Roll-Out" ejector actuated by a pushing ram requiring minimum power, large low-pressure tires to provide maximum flotation, a special new wide pusher plate, tire cleaning guards, rugged formed steel construction, easy accessibility for lubrication and service, and simple cable reeving for longer cable life. **Wooldridge Manufacturing Company, CE 9-123, Sunnyvale, Calif.**

Model OS-152

Equipment, Materials & Methods (Continued)

Loader Attachments

FIVE NEW ATTACHMENTS to increase the job flexibility of Scoopmobile Model LD10 and LD5 front-end loaders have been announced. Included on the list are lift forks, backfill blade, crane boom, concrete hopper and a dozer blade. Their use eliminates the need for "extra" equipment on the job. The lift forks, backfill blade and concrete hopper mount directly



Dozer Blade

on the hydraulic boom, replacing the scoop and using standard fittings for fast change-over. The dozer blade, for the LD10 only, attaches directly to the chassis, which takes up the strain of heavy dozing. Bucket remains on the boom. Both the LD10 and LD5 feature four-wheel planetary drive, four-wheel power steering, all-hydraulic operation and the twist-turn flexibility of Mixermobile's exclusive Pow-R-Flex coupling of two separate power axle elements. **Mixermobile Mfg., CE 9-124, Public Relations Div., 8027 N. E. Killingsworth, Portland 20, Ore.**

Conveyor

A CONVEYOR specially designed for contractors and builders, called the Fairfield Builder, handles bricks, blocks, tile, mortar, lumber, gypsum, roofing, dirt, sand and other building material. It is available in two models. The Flare Top, Model 270, has the deeper trough and conveys all building materials except those wider than 16 in. For elevating wide insulating board, corrugated roofing or siding the Flat Top, Model 271, is available. By adding one or two 8 ft boom sections, the 24 ft base machine can be converted into a 32 ft or 40 ft conveyor. In one min. the Builder carries from ground to roof 70 bricks, 35 concrete blocks, or 35 rolls of roofing. Because of its balanced construction, one man can move it from place to place on the job and it can be readily towed from job to job by either truck or car. Other features of the Fairfield Builder include all-steel construction, special slip-clutch and brake assembly, lightweight carriage with high speed wheels, ratched type hand hoist for raising and lowering the boom, and removable base for either gasoline engine or electric motor. **Fairfield Engineering Co., CE 9-124, Barnhart St., Marion, Ohio**

Literature Available

Fire Extinguishing Equipment—An 8-page bulletin describes all types of portable fire extinguishers for Class A, B, and C fires. The brochure also outlines smoke and temperature-rate-of-rise fire detection systems as well as automatic carbon dioxide extinguishing systems for machinery and entire rooms. Ask for Bulletin P8R5. **Walter Kidde & Company, Inc., CE 9-125, Main St., Belleville 9, N.J.**

Wire Rope—Fifty-six continuous scenes, one to a page like a film showing, takes the reader on a picture-story-tour of wire rope making. Starting with wire rods, the tour takes in metallurgical checking, wire drawing, testing, rope making, and includes slings, aircraft cable, and cable assemblies. Ask for Booklet No. 5312. **Macwhyte Company, Adv. Dept., CE 9-125, Kenosha, Wis.**

Rubber Linings—An illustrated, two-color, 8-page bulletin describing the advantages and application of rubber lining to steel tanks, drums, pipes, valves, fittings and pumps has recently been published. Included in the bulletin are important tables giving the resistance characteristics of MW rubber lining to inorganic acids, salts and alkalies, organic materials and a wide group of miscellaneous materials. Details on the chemical, abrasive and temperature resistant qualities of rubber linings and the different types of linings available are also given. Metalweld's plant facilities for cementing, lining, and vulcanizing all types and sizes of equipment are illustrated, and the B. F. Goodrich Vulcalock Bonding Process, which joins rubber and steel together with a bond strength of over 500 psi, is described. **Protective Coatings Div., Metaweld, Inc., Scotts Lane & Abbotsford Ave., Philadelphia 29, Pa.**

Industrial Lighting—An American Standard Practice for Industrial Lighting has recently received full approval of the A.S.A. and is being published in a 40-page booklet. Completely revising the first recommended practice on this vital lighting problem published ten years ago, the new standard is designed to meet today's superior lighting requirements and covers many specific lighting problems not included in the 1942 report. The price is 50¢; quantity prices on request. **Publications Office Illuminating Engineering Society, CE 9-125, 1860 Broadway, New York 23, N. Y.**

Tubular Steel Scaffolding—Building and maintenance contractors will be interested in the literature available on Advance Tubular Steel Scaffolds. Six page color folder, No. 53, illustrates various panel styles and identifies proper application. It contains a description of the patented method of panel and brace assembly with self-contained Cam and Stack locks which speed up assembly and dismantling through elimination of bolts, nuts, clamps and other time consuming methods of attachment. **Advance Scaffold Div., Beaver Art Metal Corp., Dept. B 18, Ellwood City, Pa.**

Literature Available (Continued)

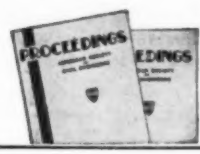
Electric Shovel—A bulletin describing the Marion 111-M Ward-Leonard Electric shovel is announced. The unit carries a standard 4-yd dipper or bucket, and is featured as shovel, dragline, clamshell, crane, and coal loader. As dragline, the bucket capacity varies from 3–4½ cu yds, depending on the length of boom. Its rated crane capacity is 165 tons. The 12 page, two color booklet contains illustrations of the unit in many material handling applications. Outstanding features of the 111-M electric shovel are mentioned. **Marion Power Shovel Company, CE 9-126, Marion, Ohio**

Method of Preparing Concrete for Plastering—A folder illustrating Kif, a product for attaching ceramic tile direct to concrete on tunnel construction, is offered. Specifications, applications, and general information is included. **Buffalo Products, Inc., P.O. Box 48, Murray Hill Station, New York 16, N.Y.**

Aircraft Structures—"Standardized Hangars by Luria" is the title of an illustrated catalog on structures for civil and military aircraft. Available on request to industrial and governmental executives throughout the world, the catalog contains descriptions, photographs, cross-sectional drawings and specifications of various types of standardized hangars, lean-to's and clear-span service buildings. Highlighted advantages are the lower costs made possible by the company's mass-production methods, the speed of erection, the permanence of steel-frame design and the adaptability of the structures to special requirements. **Luria Engineering Co., CE 9-126, 500 Fifth Ave., New York 36, N. Y.**

Pumps—A bulletin covering a line of SESC (standard end suction centrifugal) pumps is now being offered. The SESC pumps provide an overall line of centrifugal pumps covering the widest variety of applications and offering maximum interchangeability of parts. The line covers six types of pumps with varieties of mountings, frames, and drives. The bulletin, No. W-300-B4 also includes charts to illustrate the coverage provided by the six types of pumps in the SESC line. **Worthington Corporation, CE 9-126, Centrifugal Pump Div., Harrison, N. J.**

Control Systems—A 16-page picture-story bulletin describing Cabinetrol low-voltage control systems has been announced. Designated as GEA-3856, the two-color publication uses more than 35 pictures to explain the construction, installation, and protective features of the control units. Reference and selection charts on the 24 and 40 in. deep models are included for squirrel-cage, synchronous, and wound-rotor motor controls as well as for lighting panelboards, lighting single-phase circuit transformers, incoming-line and feeder units, and for automatic throw-over units. **General Electric Co., CE 9-126, Schenectady 5, N.Y.**



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The following papers have become available as Proceedings Separates. Following the date of issue of a paper, discussions thereof will be received for a period specified in the paper. Titles will be added every month, as they become available. Use the convenient order form on page 128.

198. **Live Loading for Long-Span Highway Bridges,** by R. J. Ivy, T. V. Lin, Stewart Mitchell, N. C. Raab, V. J. Richey, and C. F. Scheffey.

199. **Plates with Boundary Conditions of Elastic Support,** by S. J. Fuchs.

D-134. Discussion of Paper, **Solution of an Hydraulic Problem by Analog Computer,** by R. E. Glover, D. J. Hebert, and C. R. Daum.

D-141. Discussion of paper, **Effect of Entrance Conditions on Diffuser Flow,** by J. M. Robertson and Donald Ross.

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200. **Sand Compaction by Vibroflotation,** by Elio D'Appolonia, Callix E. Miller, Jr., and Thomas M. Ware.

201. **Wind Loads on Truss Bridges,** by John M. Biggs.

202. **The Application of Heaviside's Step-Function to Beam Problems,** by John E. Goldberg.

203. **Control of Aquatic Growths in Reservoirs by Copper Sulfate and Secondary Effects of Such Treatment,** by Ray L. Derby and D. W. Graham.

204. **Engineering and Economic Problems Involved in Airport Location,** by Robert N. Cook.

205. **Bending of a Constrained Circular Beam Resting on an Elastic Foundation,** by Enrico Volterra and Randall Chung.

206. **The Effects on Structures of Winds of Hurricane Force,** by Herbert S. Saffir.

207. **Current Research in Sanitary Engineering at the University of Florida,** by David B. Smith.

208. **The Key West Aqueduct,** by P. Corradi and Burr Lenhart.

209. **The Gilmore Street Bridge, Jacksonville, Florida,** by Paul M. Huddleston.

210. **Mapping the Unknown Everglades,** by Jon S. Beazley.

211. **Photoelastic Analogy for Non-Homogeneous Foundations,** by Allen J. Curtis, and F. E. Richart, Jr.

212. **Topographic Mapping by the U.S. Geological Survey in Florida,** by Daniel Kennedy.

213. **Hydraulic Problems of Local Interests under the Central and Southern Florida Project,** by Herbert C. Gee.

214. **Planning and Operating Turnpikes,** by Charles M. Noble.

215. **Load Tests of Soils in the Miami Area,** by J. Calvin Jureit.

216. **The John E. Mathews Bridge, Jacksonville, Fla.,** by Maurice N. Quade and Richard S. M. Lee.

217. **Design of Monolithic Concrete Frame —Prestressed,** by K. P. Milbradt and T. J. Kofodimos.

218. **Wind Velocities During Hurricanes,** by Robert C. Gentry.

219. **Investigation of the Dead Load Stresses in the Mississippi River Veterans Memorial Bridge at East St. Louis, Illinois,** by L. T. Wyly, R. W. Kluge, K. H. Lenzen, L. B. McCammon, M. B. Lagaard, and E. W. Larson, Jr.

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